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LEGUMINOUS CROPS AND THEIR PLACE IN THE BUILDING UP OF SOIL FERTILITY.

NECESSITY FOR THE PRESENCE OF NITROGEN-FIXING BACTERIAL NODULES ON THE ROOTS.

PURE CULTURES OBTAINABLE FROM PLANT PATHOLOGY BRANCH.*

(For quantities available, prices charged, etc., see page 109; for directions for use see pages 111 to 114. Orders should be lodged at Department of Agriculture a fortnight or so before cultures are intended to be used.)

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INTRODUCTORY—HOW PLANTS GROW.

All plants possessing the green colouring matter known as chlorophyll, that is to say, all plants commonly met with in our everyday life, require, for their successful growth, certain chemical elements, known as carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, magnesium, calcium and iron. These ten substances were formerly considered to be all that they required, but of recent years it has been found that certain other elements are also required by some species in comparatively small amounts. Such additional substances are—aluminium, silicon, sodium, chlorine, manganese, boron, zinc, and copper, etc. All of the elements required are taken in by the plant from the soil, with the exception of the carbon, which enters the plant tissues through thousands of tiny breathing pores in the leaves, in the form of the gas called carbon dioxide.

The gas known as nitrogen, which comprises four-fifths of the volume of the air, which completely surrounds the above-ground parts of plants, may also be obtained by certain plants directly from the air, but only under the very special circumstances which will be referred to later.†

The elements essential for the successful growth of plants do not appear to be able to replace one another to any great extent, if at all, in the functioning of

* This article has been re-written from an article by the same author which appeared in the "Journal of the Department of Agriculture of Western Australia," Vol. 10 (2nd series), No. 4, pages 470-478, December, 1933, under the title of "Nitrogen-fixing Bacteria for Leguminous Plants," and which was subsequently reprinted as Leaflet 323, 5th edition. This leaflet is now out of print, necessitating the re-writing of the article.

† The average composition of normal air by volume may be taken as follows:—Nitrogen 76.96 per cent.; oxygen 20.65 per cent.; water vapour 1.4 per cent.; argon and other inert gases 0.94 per cent.; carbon dioxide 0.03 per cent.; hydrogen, ammonia, ozone and nitric acid 0.003 per cent.—Newth's "Inorganic Chemistry," pp. 256 and 270, 1920.

the plant. Thus a soil which already contains ample potash, for example, in a form in which the plant is able to use it (that is to say, "available" potash) will not have its crop-producing power (fertility) increased by additional quantities of potash, if some other essential element is deficient in proportionate amount. A lot of extra flour or water in a cake, which has to be made to a specific recipe, will not make up for a lack of currants or milk, and the same sort of argument applies to plant nutrition also.

Experience has indicated that most soils contain, in available form, abundance of every chemical element required by plants, with the exception of the three substances, phosphorus, potash, or nitrogen. The deficiency of phosphorus, generally referred to in agriculture as "phosphoric acid," is usually remedied by the use of superphosphate, blood and bone, or bone dust; that of potash by sulphate, or muriate, of potash, wood ashes, or Kainit; that of nitrogen by sulphate of ammonia, blood and bone, nitrate of soda, "farmyard manure," etc., or, most cheaply of all, by the growth of leguminous crops bearing nitrogen-fixing bacterial nodules on their roots, followed by their ploughing under, or feeding-off, by stock, on the spot where grown, before other kinds of crops are sown.

THE MEANING OF THE TERM "LEGUMINOUS CROPS."

Leguminous crops are those belonging to the legume family or *Leguminosae*. All the members of this family, which are commonly met with in agriculture, can be distinguished from the members of other botanical families by the close resemblance of the structure of their flowers to that of the sweet pea or broad bean. The adjective "leguminous," which is applied to all the members of this group, arises from the fact that the fruit, *i.e.*, the receptacle in which the seeds are produced, is known botanically as a "legume" or "pod."

Commonly-grown members of this family are the sweet pea, garden pea, field pea, cow pea, broad bean, soya bean, French bean, runner bean, lucerne, subterranean and all other clovers, lupins, burr and other trefoils, vetches, peanuts, wattles, dolichos, and the like.

THE HALF TRUTH, COMMONLY EXPRESSED, RE THE BUILDING UP OF SOIL FERTILITY BY THE GROWTH OF LEGUMES.

One frequently hears, and, indeed, very commonly sees in print, that the growth of leguminous crops should be encouraged by the farmer, inasmuch as these crops build up the fertility of the soil, by increasing its nitrogen content, so rendering it more suitable for the growth of other non-leguminous crops, such as grasses, etc., later on. The presumption seems to be that the growing of legumes, *ipso facto*, that is to say, by that very fact, inevitably builds up the nitrogen content of the soil where the legumes are grown. *It cannot be too firmly pointed out, however, that this is only a half truth.* The implication that *"leguminous crops increase soil fertility"* more than non-leguminous ones, is quite incorrect, unless the qualification is added, *"provided that the roots of the legumes are infected with the appropriate nitrogen-fixing bacteria."* In the absence of the appropriate nitrogen-fixing bacteria, legumes do *not* build up the nitrogen content and therefore the fertility of the soil, any more than would any other crop, such as grass. Without the presence of the appropriate bacteria, the leguminous plants, in common with all other kinds of plants, find themselves, so far as the uncombined nitrogen of the air is concerned, in somewhat the same situation as the sailors in Coleridge's story of the "Ancient Mariner"—"Water, water, everywhere, nor any drop to drink."

When, however, leguminous plants are infected with nitrogen-fixing bacteria, characteristic swellings or nodules, which vary in appearance with the particular plant species concerned, will be found on the roots. In these swellings are to be found hundreds of thousands of tiny germs (bacteria) which enable the plant possessing them, to draw freely for its nourishment on the inexhaustible supplies of gaseous nitrogen in the air—a feat which is quite impossible to plants, leguminous or otherwise, in their absence.

Although, therefore, in the absence of such nitrogen-fixing bacteria, certain varieties of legumes may make quite satisfactory growth on soils containing abundance of nitrogen combined chemically with other substances (in the form, for example, of humus compounds, poultry manure, sulphate of ammonia, urea, etc.), the full economic benefit of growing such plants can only be obtained, and the fertility of the soil, so far as its nitrogen content is concerned, can only be increased, by the growing of leguminous crops, when the appropriate bacteria are present in the soil.

EARLY HISTORY OF THE USE OF NITROGEN-FIXING BACTERIA FOR STIMULATING THE GROWTH OF LEGUMINOUS CROPS.

Observations by practical farmers extending well back into ancient agriculture have lead to the recognition of the soil-enriching qualities of crops of the legume family. Columella, an early Roman historian, mentions the fact that many Roman farmers regarded beans as possessing such qualities, but did not accept this belief for himself. On the other hand he pointed out that lucerne, lupins and vetches, improve the land and act as manure. He stated also that it was the practice of Roman farmers to plough lupins under in order to enrich the soil.*

In the centuries following the fall of Rome before the onslaughts of the barbarian hordes from the north, the use of legumes for soil improvement persisted to some extent in Italy, France and other countries; yet the practice was not followed consistently, and the fertility of European soils was declining for lack of available nitrogen, and, to a large extent, also, of phosphoric acid. The more general introduction of clover into Germany and England, in the 18th century, helped to restore the fertility of many farms, and led, ultimately, to the recognition of the peculiar place held by legumes in the maintenance of soil fertility.*

METHODS OF INTRODUCING THE APPROPRIATE NITROGEN-FIXING BACTERIA INTO SOILS IN WHICH THEY DO NOT NATURALLY OCCUR.

A common method of introducing the bacteria on to a new field, or farm, is to inoculate the new area with soil from a field which has previously grown successful crops of the kind under consideration, and on the roots of which abundant nodules have been found. This method is quite satisfactory in most cases, but has the disadvantage of sometimes introducing plant diseases, insect pests, or weed seeds. If attempted, it should be carried out preferably during dull weather, or late in the afternoon, so as to minimise the harmful effect of sunlight on the bacteria. About one hundredweight (1 cwt.) of infected soil should be used per acre and be well cultivated or harrowed in.

Another method of inoculation sometimes used is to dip the seeds before sowing in some sticky but harmless substance such as skim milk, thin glue, or a sugar-syrup made by dissolving cane-sugar in hot water and then cooling before use. The seeds are made sticky by the treatment, and, after being dried as much as possible

* Marshall, C. E.—"Microbiology," 3rd edit., Part 3, Division 3, Chapter 3, pp. 400-416. (P. Blakiston's Son and Co., Philadelphia, 1921.)

by being spread out in a shady place, are rolled about in a little soil containing the bacteria. The sticky seeds take up a coating of the bacteria-infected soil and then are sown as soon as possible.

Where the crop has already been planted, an 8-ounce bottle of culture (see below) may be used to inoculate about one hundredweight of sweet, moist, fertile soil, by first mixing the bacteria with water. The heap is thoroughly mixed by repeated turning, and is then allowed to stand in a cool, shady, place for a day or so, before broadcasting it over the field at the rate of about one hundredweight per acre. This method does not appear to give nearly as satisfactory results as seed inoculation, at least, for annual crops.

DEVELOPMENT OF PURE CULTURES OF NITROGEN-FIXING BACTERIA.

In 1888, Beijerinck reported the first successful growth of the nitrogen-fixing bacteria on artificial food materials in the laboratory. The matter was taken up by the United States Department of Agriculture about 1902.* In Western Australia, pure cultures grown on artificial media were first used in 1926, since which time some two thousand odd have been distributed to farmers in all parts of this State, by the Plant Pathology Branch of the Department of Agriculture, mainly in the past three or four years.

In newly-settled areas, so far remote from fields already inhabited by the desirable bacteria that the obtaining of infected soil is not easily, or economically, practicable, the artificial cultures have been found a great boon. They have been used in the past, in all parts of the State, particularly on newly-cleared land, with great success. Some cultures have even been dropped to farmers from aeroplanes. They are free from weed seeds, insect pests, or organisms causing plant diseases, and in this respect are much to be preferred to the use of soil containing the nitrogen-fixing bacteria.

By the use of the pure cultures, a good stand may be obtained during the very first year, instead of having to wait three or four years, as is otherwise often the case in subterranean clover paddocks, lupin, lucerne, field pea or cow pea plantings, and so on.

THE REASON FOR THE SLOW RATE OF ESTABLISHMENT OF LEGUMINOUS CROPS IN MANY CASES.

The reason why leguminous crops planted by means of uninoculated seed frequently take three or four years to become well established, but at the end of this time may thereafter do very well, is that Nature has so arranged matters that, generally, if no artificial steps are taken to deliberately introduce the bacteria, a few of the seeds planted will be naturally infected with the appropriate organisms. Although the rest of the seeds which are planted may give rise to only very poor plants, plants growing from the naturally infected seed will develop some nodules on their roots and may do quite well in the first year. As a matter of fact, these will frequently be noticed standing "a head and shoulders," so to speak, above the rest of the plants in the paddock.

In the course of time, the bacteria present on these few oustanding plants will become distributed over a very much larger area of soil, by reason of wind-blown soil, surface water "run-off," or cultivation implements, spreading them from the original spots where they first became established. In the course of three or four years, then, the whole of the area on which the leguminous crop was first planted,

*Marshall, C. E.: "Microbiology," 3rd edit., Part 3, Division 3, Chapter 3, pp. 400-416. (P. Blakiston's Son and Co., Philadelphia, 1921.)

will often have become naturally infected with the nitrogen-fixing organisms, and all the leguminous plants, of the original species, thereafter growing there may do very well.

There is no need, however, to wait such a long time as this, as by the use of pure cultures of the appropriate bacteria for inoculating the seed before it is planted, a thoroughly satisfactory stand may be obtained over the whole area during the very first year of growth.

PURE CULTURES OBTAINABLE FROM PLANT PATHOLOGY BRANCH.

Pure cultures of the nitrogen-fixing bacteria which form nodules on the roots of certain species of the family *Leguminosae*, may be obtained, on application to the Plant Pathologist, in the quantities, and at the prices, indicated below.

The bacteria are supplied on the surface of jelly-like agar slopes in one-ounce, two-ounce, or eight-ounce medicine bottles. To cover the cost of chemicals, glassware, wrappers, postage, and, to some extent, the considerable amount of time taken in the preparation and dispatch of each culture, the following small charges are made:—

A. 1 ounce size—1s. 6d. (Post free.)
B. 2 ounce size—2s. 6d. (Post free.)
C. 8 ounce size—5s. 0d. (Post free.)

The contents of a one-ounce bottle will inoculate approximately fifteen lbs. of small seed, such as lucerne or subterranean clover, and approximately 30 lb. of larger seed, such as peas, or soy beans.

The two ounce size and the eight ounce size will treat approximately two and four times the quantity of the smallest size, respectively.

If, at any time, a given size of culture is used for less seed than that stated above, the excess will do no harm. On the other hand, each culture may be used "at a pinch" to inoculate up to twice as much seed as stated above; although it is better, as a general rule, to adhere rather strictly to the quantities stated. If more seed than that recommended is inoculated, special care must be taken to see that the heap of inoculated seed is thoroughly mixed together a number of times, to ensure that each seed will pick up its own proper quota of bacteria.

Table 1.

APPROXIMATE AMOUNT OF SEED WHICH MAY BE TREATED WITH ONE BOTTLE OF CULTURE.

Size of bottle	Price.	Seed of size of lucerne or sub-clover, etc.	Seed of size of garden pea, lupin, soy beans, etc.	Milk required.	Tri-calcium phosphate.
	s. d.				
1 oz.	1 6	Up to 15lbs.	Up to 30lbs.	¼-pint	1·5 gms.
2 oz.	2 6	Up to 30lbs.	Up to 60lbs.	½-pint	3·0 gms.
8 oz.	5 0	Up to 120lbs.	Up to 240lbs.	1 quart	12·0 gms.

Owing to the time taken to prepare the cultures, and owing also to the fact that all orders have to circulate through the Accounts Branch before reaching the Plant Pathologist, farmers are requested to lodge their applications at the Department a fortnight at least before they wish to use the culture.

DIFFERENT BACTERIA REQUIRED FOR DIFFERENT KINDS OF LEGUMES.

The same strain of bacteria will *not* inoculate every kind of leguminous plant. Thus trefoils and lucerne are inoculated by the same kind, but the lucerne kind will *not* inoculate clovers or peas.

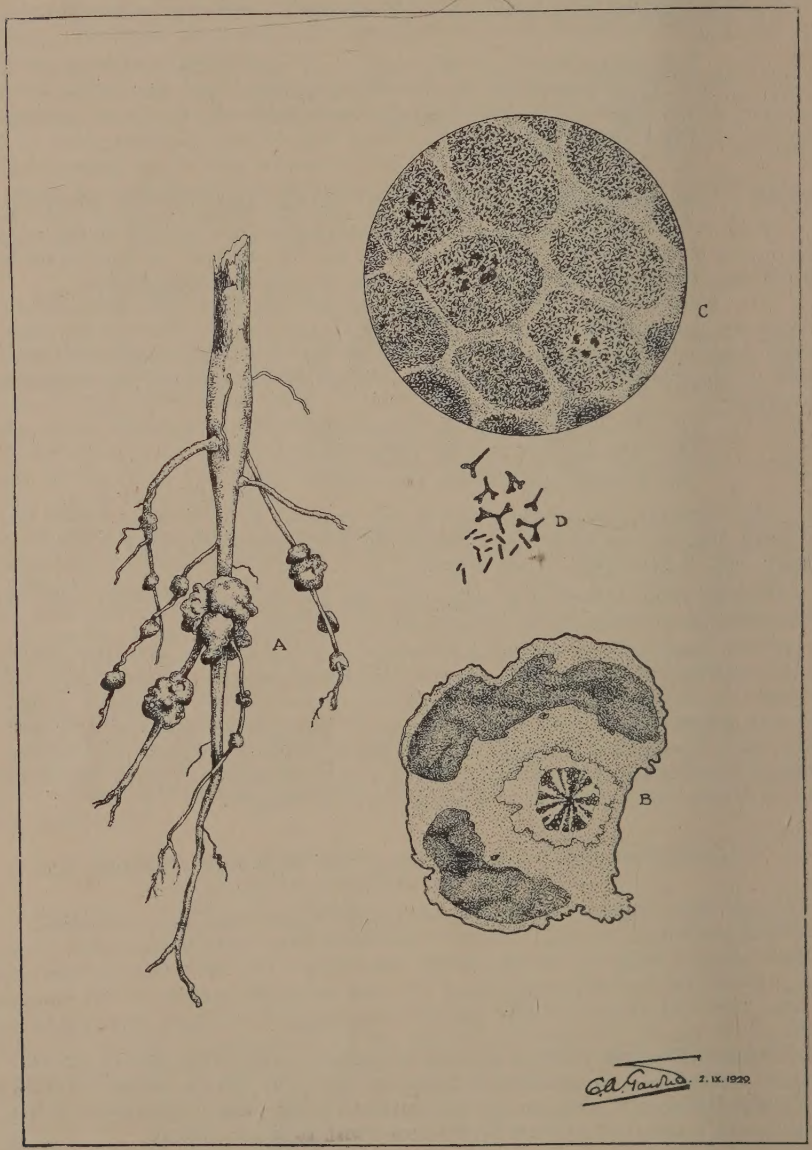


Fig. 1.—Nitrogen-fixing bacterial nodules on the root system of a W.A. blue lupin plant (*Lupinus varius L.*).

a, Root system showing bacterial nodules (half natural size); b, Section through nodule (much enlarged), showing two darkly-shaded zones containing bacterial colonies; c, nitrogen-fixing bacteria in the plant cells; d, Branching and rod forms of nitrogen-fixing bacteria; (c and d redrawn after G. T. Moore, from Harshberger, "Mycology and Plant Pathology"). (*After C. A. Gardner, this Journal, Sept.*, 1929.)

The bacteria which may be obtained from the Department will inoculate the following groups of legumes. *The members of each group are inoculated by the same kind of bacteria, but the plants mentioned in different groups require different bacteria.*

Group 1.—Subterranean clover, white Dutch clover, perennial red clover ("cow grass"), Egyptian clover, and all other true clovers (*Trifolium spp*).

Group 2.—Lucerne, white sweet clover, "King Island Melilot" ("Hexham scent"), medics, trefoils, and all other species of *Medicago or Melilotus.*

Group 3.—Garden pea, sweet pea, field pea, Tangier pea, all kinds of vetches or tares, broad bean, tick bean, lentil.

Group 4.—W.A. blue lupin (*Lupinus varius*).

Group 5.—Soy beans (*Glycine Max*).

Group 6.—Sulla (*Hedysarum coronarium*).

Group 7.—French beans (*Phaseolus vulgaris*), scarlet runner bean (*Phaseolus multiflorus*).

Group 8.—Cow peas (*Vigna sinensis*), peanuts (*Arachis hypogoea*), Japan clover (*Lespedeza spp.*), Lima bean (*Phaseolus lunatus*).

It is very important that persons ordering cultures should specify very clearly the kind of seed to be inoculated. If "pea" bacteria are ordered, for example, it is impossible to tell whether "garden" peas or "cow" peas, etc., is meant, unless the qualifying word is also indicated. The same thing applies to French and broad beans.

DIRECTIONS FOR USING THE PURE CULTURES.

Keep the bottles unopened and in a warm, dark place until about to be used. The cultures are useful for about two months after being received, but the greatest certainty of success will follow the use of the cultures within about a month after being received, provided the soil conditions are satisfactory at the time of sowing. (See next section of article.) In the bottles the bacteria appear as a whitish slime on the sloping surface only of the agar (*i.e.*, the jelly-like material containing bacterial food).

TO INOCULATE THE SEEDS WITH THE CULTURES.

The seeds should first be piled on a clean surface. Then take, in a jug, basin, or other suitable clean container, one-quarter pint of fresh skimmed milk for each one-ounce bottle, one-half pint of fresh skimmed milk for every two-ounce bottle, or one quart of fresh skimmed milk for every eight-ounce bottle of culture. Into the skim milk mix the powdered tricalcium phosphate supplied with every bottle of culture (1.5 gm. for each one-ounce bottle, 3.0 gm. for each two-ounce bottle, 12.0 gm. for each eight-ounce bottle).*

Then, little by little, transfer the whole of the agar contents of the bottle to the skim milk which is in the jug, etc., and thoroughly mix the bacterial slime with the milk. This may be done by pouring a little of the milk into the bottle, putting the thumb (which should be quite clean) over the mouth of the bottle, shaking vigorously, and then pouring back into the rest of the milk. Repeat this procedure a number of times. When this has been done, pick out the lumps of agar (*i.e.*, the solid, whitish, jelly-like material), which will probably have become broken up into small pieces by the repeated shaking.

* The original directions received from Rothamsted (see Appendix 1), called for the use of water-soluble calcium phosphate in considerably smaller amounts than those indicated above. As this is not obtainable (as such) from the local druggists the powdered tricalcium phosphate B.P. has been used instead.

Now inoculate the seed by pouring a little of the inoculated milk on to the heap of seed from time to time, and thoroughly mixing, with the hands or a clean stick, etc., until every seed is moistened. The seed should not, however, be made too wet. If any of the inoculated skim milk is left over, it should be mixed up with water and spread on a few yards of soil where the seeds are to be planted. The lumps of broken agar can also be thrown with advantage on to this area. On the other hand, if there is not quite enough inoculated milk to thoroughly moisten all the seeds, the jug, etc., which formerly contained the inoculated skim milk should be rinsed out with further skim milk, and more added to the heap of seeds, until, on repeated mixing, every seed is uniformly moistened with the inoculated milk.

If sweet skim milk is not available, a commercial brand of powdered skim milk, mixed up with water according to the maker's directions, or even plain water, may be used instead. The milk is better, however, as it causes better adherence of the bacteria to the seed on drying.

It usually takes about one-quarter pint of milk for each 15 lbs. of small seeds such as lucerne, or 30 lbs. of larger seed, such as peas. The larger the seeds, the less culture and skimmed milk required for inoculation of a given weight of seed, and *vice versa*.

Once any bottle of culture has been opened, the whole of the contents must be used on the one occasion, otherwise foreign organisms, which are always present in the air, milk, etc., in the form of fungal or bacterial spores, and so on, may gain entrance to the bottle, germinate, and commence to grow on their own account, thus more or less smothering and contaminating the original bacterial growth.

Where a number of farmers in the one locality are each desirous of making successive sowings of only small quantities of seed at any one time, a good plan is for them to club together, dividing the cost of the necessary number of cultures proportionately among them. The total amount of seed to be inoculated at any one time is then brought to the one spot when the time comes for inoculating the seed.

The seed of each farmer is kept in a separate heap, but a proportionate amount of the inoculated milk obtained from the use of one bottle of culture is used to inoculate each separate heap of seeds.

THE SOWING OF THE INOCULATED SEED.

Inoculated seeds should be sown as soon as possible after inoculation. If the seeds are too wet to sow immediately the inoculation process is completed, they should be allowed to dry in a cool, shady place. Under no circumstances should the cultures in the bottles, or the inoculated seeds, be left exposed to the sunlight, as it tends to destroy large numbers of the bacteria. On account of the injurious effect of sunlight on the bacteria, it is advisable that the seed be sown through a drill, or, if it is broadcast, it should be immediately harrowed in.

Experiments carried out by Dr. H. G. Thornton in England, with inoculated lucerne seed, have clearly shown that it is important to plant the inoculated seed as soon as possible after inoculation.* Taking the number of nodules obtained after storing the seed, before planting, for only one day after inoculation, as 100 per cent., he found that storing the seed for 14 days after inoculation caused a reduction in the number of nodules to 61 per cent.

* Thornton, H. G.—"The Influence of the Number of Nodule Bacteria applied to the seed upon nodule formation in Legumes." Journ. Agric. Science, Vol. 19, Part 2, pp. 373-382, April, 1929.

A further reduction to 49 per cent., in the number of nodules formed as a result of further storing for another fortnight was negligible.†

The number of nodules resulting from inoculation increased with each decrease in the size of the parcel of seeds being treated with one culture. In these experiments the yield of the inoculated plots was double that of the uninoculated.

A further point of importance, is that the inoculated seed should, wherever possible, *be planted only in moist soil.* Under such conditions, the organisms soon make their way in the soil moisture to a suitable depth in the soil, so that they are protected from the injurious effect of the sunlight. Should it be absolutely necessary to plant in dry soil, for some reason or other, care should be taken not to plant the inoculated seed on the surface of the soil, unless it is immediately covered over in some way, such as by the use of harrows, so as to protect the bacteria from the injurious effects of the heat and light of the sun.

From the point of view of ensuring a maximum degree of success with the inoculation process, *it is also very important that the inoculated seed should not be sown at the same time as artificial fertilisers.* Artificial fertilisers, such as superphosphate or other chemical substances, have a very marked killing effect on the nitrogen-fixing bacteria, which become attached to the seed coats during the inoculation process. The effect of artificial fertilisers, in the dry form, on the bacteria, is to draw out moisture from them and so bring about their death in greater or lesser numbers, depending on the length of time which elapses between the contact of the inoculated seed and fertiliser, before the fertiliser becomes diluted down by contact with soil moisture.

If the soil is moist at planting time, the inoculated seed may safely be run through the seed box, or a special "small seeds" attachment for the seed and fertiliser drill, which can be obtained from such firms as H. V. McKay-Sunshine Harvester Co. Ltd., etc., provided that the fertiliser is not mixed with the seed, but is fed on to the land from the fertiliser box of the drill. Under such conditions, the seed and fertiliser will only be in contact for a very short time before they both reach the moist soil. The fertiliser will then speedily become diluted down by the soil moisture, so that only a minimum of injury, if any, will be done to the bacteria.

The ideal method of planting inoculated seed is to sow the fertiliser separately from the seed in moist soil, a day or two before the inoculated seed is planted. The fertiliser will then have time to become fairly intimately incorporated with the soil particles, owing to the dissolving action of the soil moisture, and the bacteria will not be injured, but, indeed, if superphosphate is the fertiliser concerned, will be greatly stimulated by its presence. This method of planting the inoculated seed is, of course, a somewhat expensive procedure, from the point of view of the extra labour involved, but when the advantages of satisfactory inoculation of the soil with the appropriate bacteria are taken into consideration, the additional immediate expenditure is of very little ultimate consequence.

It is most important that the inoculated seed and the fertiliser should not be mixed together, as is sometimes done, as, under such conditions, not only may most of the bacteria present on the seed be destroyed, but the germination of the seed itself may be very considerably lowered if the seeds remain in contact with the fertiliser for as little as 24 hours.

† It is interesting to note that Thornton found one (? test-tube) culture per 56 lbs. of seed gave 2,500 bacteria per seed. One culture per 7 lb. of seed gave 20,000 organisms per seed. Each culture contained, on the average, 28,000,000,000 viable organisms. A pound of lucerne seed contains about 200,000 seeds.

The slight extra trouble which is necessary when planting inoculated seed, is the only disadvantage which results from the use of inoculation—the cost of the culture itself, when distributed over the total amount of seed being inoculated, being negligible.

Summed up, for any really worth-while advantage from the inoculation of leguminous seeds to accrue with certainty, it is essential that the seed and the fertiliser be separately applied, in some way or other, to the soil, which itself should be nicely moist before either the seed or the fertiliser is distributed.

WARNING—THE CULTURES ARE NOT A CURE-ALL.

Growers are warned that the *only* function of the nitrogen-fixing bacterial cultures—although an exceedingly important and valuable one—is to enable leguminous plants to make free use of the inexhaustible supplies of gaseous nitrogen in the air.

Nitrogen is an essential food material for all plants. By most species, however, it can only be obtained, in spite of its very great abundance in an uncombined form in the atmosphere (*see* footnote to the first page of this article), in the form of compound substances (nitrates, urea, ammonium carbonate, etc.). Such compound nitrogenous substances are formed in the soil as a result of the decomposition of organic matter (plant or animal matter) or from such artificial fertilisers as sulphate of ammonia, nitrate of soda, ammonium phosphate, and so on.

Where other kinds of plants would fail to thrive, because of a deficiency of combined forms of nitrogen in the soil, legumes may succeed splendidly, provided they are equipped with nitrogen-fixing bacterial nodules on the roots.

These nodules *cannot*, however—

(1) Take the place of good drainage.

(2) Remove salt from the soil.

(3) Provide other necessary food materials such as lime, phosphoric acid, or potash.

(4) Prevent plant diseases or insect pests, and so on, as some farmers in the past appear to have imagined.

SUMMARY AND CONCLUSION.

To summarise:—

1. Where other kinds of plants would fail to thrive because of a deficiency of combined nitrogen in the soil, legumes may succeed splendidly, provided that they are equipped with nitrogen-fixing bacterial nodules on the roots.

2. The appropriate bacteria may be added to the soil most satisfactorily by inoculating the seed with pure cultures of the bacteria before sowing.

3. Where soil nitrogen in a combined form is the limiting factor in the growth of crops such as grasses, maize, vegetables, etc., it can be added to the soil most cheaply by the growing of leguminous crops from inoculated seed, and by the feeding off, on the spot, or ploughing under, of such plants, before the other types of crops are sown.

4. In the case of citrus and deciduous orchards, and vineyards, leguminous cover crops planted in the autumn, if infected with the nitrogen-fixing bacteria, are invaluable for the building up of soil fertility, and will very largely eliminate the necessity for the use of artificial nitrogenous fertilisers.

5. *The ideal system of maintaining or improving soil fertility is to grow leguminous crops from inoculated seed, liberally manure them with superphosphate and potash, where these fertilisers are required, and subsequently feed them off, in situ, or plough them under, when well developed, to add their cheaply-obtained nitrogen content to the soil, in a form in which other, non-leguminous crops can use it.*

. . . . . .

It may be mentioned here that it will often be found of great value in the successful establishment of leguminous crops, in those cases, such as lucerne plots, where the high value of the crop per acre warrants the expense, to broadcast up to a ton or so of air-slaked lime or Dianella lime sand per acre several months before sowing the seed. The lime will remove soil acidity (sourness), improve the physical, chemical and biological properties of the soil, and greatly stimulate the development of the nitrogen-fixing bacteria.

USERS ASKED TO REPORT RESULTS OBTAINED FROM THE USE OF THE CULTURES.

It would be greatly appreciated if persons using the cultures would sow several rows of uninoculated seed before opening the bottle, or bottles, and then subsequently plant the inoculated seed alongside, using the same fertilisers, etc., and report any differences in growth or yields, etc., obtained.

APPENDIX I.

History of the Distribution of Nitrogen-Fixing Bacterial Cultures in W.A.

Full details of the history of the distribution of nitrogen-fixing bacterial cultures in Western Australia from the time when the Department obtained its first culture in 1926, from the Rothamsted Experiment Station, England, up to the end of November, 1933, were set out in the article by the same author appearing in this Journal for December, 1933, pages 470-478, under the title "Nitrogen-fixing Bacteria for Leguminous Plants." (Subsequently issued as Leaflet 323, 5th edition.)

The following is a brief summary of the position to date:—

In 1926 this Department obtained a pure culture of the lucerne root organism (*Rhizobium radicicola*), from the Rothamsted Experiment Station, England, on the initiative and through the good offices of Mr. F. W. Strack, General Manager of the Primary Producers' Bank of Australia, London, England.

This organism was subcultured and distributed to farmers in various parts of the State by the then Botanist and Plant Pathologist, Mr. W. M. Carne, with the result that successful stands of lucerne were obtained in many places where success with this crop had previously not occurred. The same strain has been grown on artificial media ever since, and is still being distributed to farmers in this State, who are using it with great success.

With the passage of time, nitrogen-fixing bacteria for other kinds of leguminous plants have gradually been acquired from various sources. Wherever farmers have planted uninoculated seed alongside inoculated they have almost invariably reported an enormous difference in favour of the treated seed. This is readily understandable, as Western Australia, and particularly the extreme south-western portion of it, is agriculturally very young, so that, in nearly every instance, leguminous crops are planted on soil which has not previously grown the same crop, or a crop carrying the same kind of organism on its roots. In many cases, burnt-over forest country, or newly-cleared land is planted, so that it is just as necessary to introduce the appropriate bacteria, from an outside source, as it is to introduce the seed of the crop itself.

By the use of the cultures, it has been found that a good stand of subterranean clover, for example, may be obtained in the first year from clean, machined seed, whereas from similar seed, not inoculated, a satisfactory stand frequently does not result on new ground until the third or fourth season after sowing.

The following extracts have been taken from Annual Reports of the Plant Pathologist from 1928-9 onwards. No information is given in the reports for 1926-7 and 1927-8 as to the numbers of cultures sent out to farmers during those periods, but they were probably fewer than those for the period 1928-9.

Number of nitrogen-fixing bacterial cultures distributed annually from July 1st, 1928, to 30th April, 1935.

(a) 1928-9	37	(f) 1933-34	557
(b) 1929-30	192	(g) 1934-35	579
(c) 1930-31	198		
(d) 1931-32	217	Total	2,053
(e) 1932-33	273		

APPENDIX II.

Preparation of Legume Root-Soy Bean Agar for Growth of Nitrogen-fixing Bacteria.

The method of preparation of agar media for the growth of nitrogen-fixing bacteria in this laboratory, which has been used with great success since 1930, is given below for the sake of workers in other laboratories who may be interested.

The formula is a modification of that originally received from the Rothamsted Experiment Station, England, with our first lucerne culture. All the organisms listed above as being supplied to farmers, are grown on the same agar with great success.

The soy beans were first introduced into the formula when our first soy bean culture was received, and we were unable to obtain any soy bean roots. So vigorous was the growth made by all the strains of the organism as a result of the modification, that soy beans have been used in making up the agar ever since. When the sulla organism was first isolated, it did not seem to be able to grow on this agar and was grown for a time on agar similarly prepared except that sulla roots were used instead of the lucerne, trefoil or "Hexham Scent" roots normally used. Now, however, it grows quite well on our usual agar.

To Prepare Legume Root-Soy Bean Agar for the Growth of Rhizobium radicicola.

Take 50 gms. well washed roots of lucerne (*Medicago sativa*), or burr trefoil (*Medicago denticulata*) or "Hexham scent" (*Melilotus indica*) (or mixtures of these). Burr trefoil roots give the most vigorous growth on the whole, followed by "Hexham scent" and then lucerne. Add 10 gms. soy beans. Mince well in meat mincer or chop up finely. Add three times the volume of water. Boil one hour, and then stand 24 hours. Filter through cotton wool and make the extract up to 1,000 ccs. with water. (Tap water is used throughout.) Add the following chemicals:—

Dipotassium monohydrogen phosphate ..	1.0 gm.
Magnesium sulphate	0.2 gm.
Sodium chloride	0.1 gm.
Calcium chloride	0.1 gm.
Ferric chloride (2 drops concentrated solution)	0.02 gm.
Powdered Agar—	
In Winter	20 gms.
In Summer	25 gms.

Dissolve the agar by autoclaving. Filter (if desired) through cotton wool and add—

Calcium carbonate	5 gms.
Sucrose	10 gms.

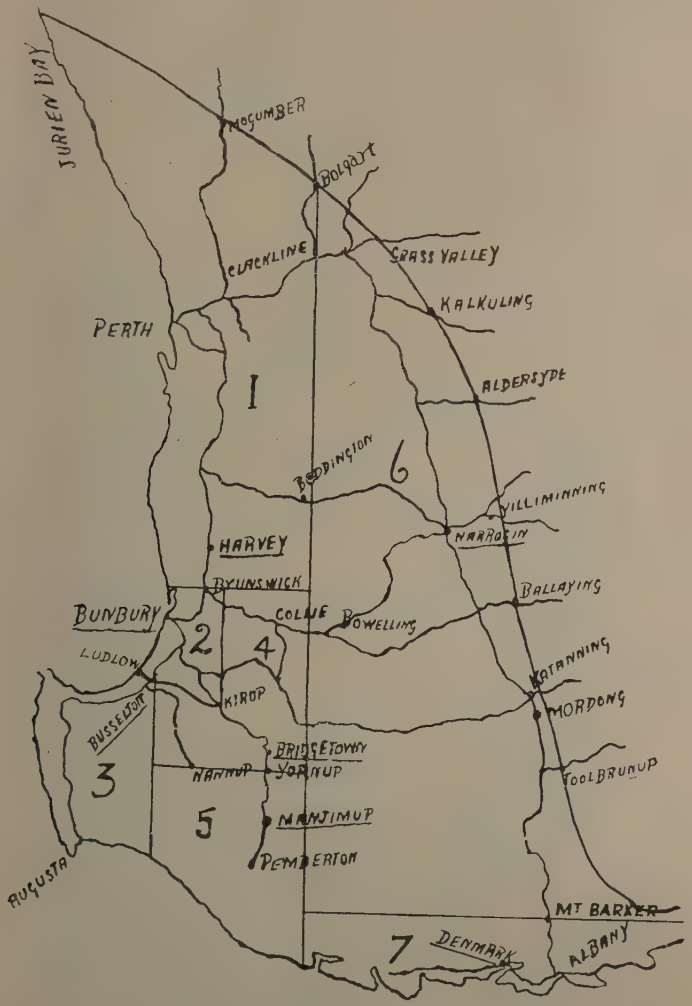
Keep the agar well agitated by constant movement of the flask so as to ensure even distribution of the calcium carbonate.

Pour into medicine bottles, etc., sterilise 20 minutes at 15-20 lbs. pressure and slope.

THE BETTER DAIRYING COMPETITION. 1935.

G. K. BARON-HAY,
Superintendent of Dairying, Department of Agriculture.

In view of the progressive results which have been obtained since the inauguration of the above competition, in 1932, particularly the increased conservation of fodder per cow, leading to increased production per cow, the Committee of the Australian Dairy Council in this State decided to continue the above competition for the year 1935.



Note.—The Southern boundary of Zone 6 is now a direct line through Mt. Barker.

As the original zones into which the State was divided have proved most equitable to all competitors during the previous three years, and it is also desirable to have comparisons between the same areas each year, the South-Western portion of the State was again divided into these seven areas, arranged as far as possible according to climatic and soil conditions, as shown in the above map.

The scale of points under which the awards were made were drawn up by the writer in collaboration with the late Mr. Percy Rose, of Burekup, and were slightly altered from those of previous years to still further stress the importance of conservation of fodder and pasture production.

The following handicaps were imposed on those competitors who gained prize-winning positions the previous year:—

First Prize winner	Deduct	15 Points.
Second Prize winner	„	10 „
Third Prize winner	„	5 „
Fourth Prize winner	„	1 „

Scale of Points—Better Dairying Competition.

		Max. Points.
1.	Conservation of Fodder and Summer Fodder Crops (300 points) –	
	(a) *Hay*—Quality, Condition	60
	(b) *Silage*—Quality, Type, Wastage, etc.	60
	(c) *Summer Fodder Crops*—Cultivation, Disease, Yield	50
	(d) Amount conserved per cow	130
2.	Pastures (240 points)—	
	(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150
	(b) Management, Fertilisation	90
3.	Dairy Herd (120 points)—	
	(a) Breeding and Dairy Type	60
	(b) Condition and Freedom from Disease	30
	(c) Herd Sire—(i) Pure-bred	20
	(ii) Ex-tested Dam	10
4.	Returns per Acre (120 points)—	
	(a) Butter Fat, lb. per acre	100
	* Sidelines	20
5.	Pigs (30 points)—	
	(a) Breed, Type, and Condition	10
	(b) Number of breeding Sows in proportion to milch Cows	10
	(c) Housing, Feeding and Management	10
6.	Farm Management (140 points)—	
	(a) Lay-out, Convenience, etc.	50
	(b) Sanitation—(i) General	30
	(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk	40
	(c) Book-keeping and Records	20
7.	Utilisation of Skim Milk (50 points)—	
	Based on number of pigs reared and calf-months per cow	50
	(5 months—1 calf—1 pig)	
	Total	1000

* Pigs, Poultry, Vegetables, etc.

A perusal of the above schedule of points will show the great importance attached by the framers of the competition to fodder conservation, pasture production and summer fodder crops, as no less than 540 points in a total of 1,000 were allotted to these items.

As in previous years, judging was carried out by officers of the Dairy Branch, Department of Agriculture, and as the competition embraced areas of varying climatic conditions, and rainfall ranging from 20 to 70 inches per annum, it was found necessary to spread the judging, so that each zone was judged under as near the same seasonal conditions as possible.

The dates of judging were as follow:—

Zone 1	Centre Harvey ...	...	Jan. 15 to Feb. 15th, 1934
Zone 2	,, Bunbury ...	...	Jan. 1st to Jan. 30th, 1934
Zone 3	,, Margaret River	...	Feb. 1st to Feb. 28th, 1934
Zone 4	,, Bridgetown ...	...	Jan. 15th to Feb. 15th, 1934
Zone 5	,, Manjimup ...	...	Jan. 15th to Feb. 28th, 1934
Zone 6	,, Narrogin ...	...	Jan. 1st to Jan. 30th, 1934
Zone 7	,, Denmark ...	...	Feb. 1st to Feb. 28th, 1934

The sum of money allotted to this work by the Committee of the Australian Dairy Council enabled the following prizes to be given:—

First Prize in each Zone—£10 and Framed Certificate.
Second Prize in each Zone—£6
Third Prize in each Zone—£5
Fourth Prize in each Zone—£1

CHAMPION DISTRICT SHIELD.

Messrs. Cuming Smith & Mt. Lyell Farmers' Fertilisers, Ltd., in order to give a wider scope to the competition, have donated the above handsome shield to be awarded annually to that district or zone containing the four leading farms. The judging for the shield is carried out by the writer in collaboration with each district judge, in order to allow for individual views of different judges.

1.—Shield donated by Cuming Smith Mt. Lyell Farmers' Fertiliser Co. To be held by the zone containing the four leading farms.

For the season 1933-34, the Champion Dairying Shield was won by No. 1 Zone, controlled by the Harvey Agricultural Society, the four leading farms being owned by:—Mr. S. F. Russell, Serpentine; Mr. W. Shaw, Harvey; Mr. G. E. Scott, Yarloop; Mr. S. Bowers, Brunswick. The results for the 1934-35 season are not yet available. The following Tables, 1-7, set out in detail the points gained by each competitor, and an analysis of the information gained has been made, the lessons to be learnt therefrom being discussed subsequently.

TABLE 1.

POINTS GAINED BY COMPETITORS IN ZONE 1.

Centre: Harvey Agricultural Society. Judge: C. Giles, Dairy Inspector, Dairy Branch.

		Points Allotted.												
	Max. Points.	W. Shaw.	G. E. Scott.	S. F. Russell.	S. Bowers.	L. Temple.	H. Piggott.	T. Hackersley.	T. Briggs.	C. H. Peterson.	A. Blackburn.	Ibe & Sons.	F. J. Devlin.	V. E. Clifton.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)														
(a) Hay: Quality, Condition ...	60	54	44	52	50	35	48	...	45	42	...	50	25	45
(b) Silage: Quality, Type, Wastage, etc.	60	60	52	20	45				47					38
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	50	20	40	40	90	100	95	20	95	90	40	60	20
(d) Amount conserved per cow...	130	130	130	130	130	63	80	50	70	75	65	55	50	41
2.—PASTURES— (240 points)														
(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150	140	130	125	125	120	130	125	120	120	120	100	118	118
(b) Management, Fertilisation	90	80	65	70	55	55	70	72	65	60	80	70	50	35
3.—DAIRY HERD— (120 points)														
(a) Breeding and Dairying Type including Butterfat Production per cow	60	52	57	50	52	55	48	52	48	52	50	55	45	48
(b) Condition and Freedom from Disease	30	29	29	27	28	26	26	26	25	26	27	27	23	24
(c) Herd Sire: (i) Pure-bred ...	20	19	19	20	19	19	18	18	20	18	18	20	18	16
(ii) *Ex*-tested Dam	10	8	10	9	4	8	10	10	8	10	...	10	10	...
4.—RETURNS PER ACRE— (120 points)														
(a) Butterfat (lbs. per acre) ...	100	46	100	79	41	71	29	56	38	50	67	54	17	18
Sidelines: Pigs, Poultry, Vegetables, etc. (per acre) ...	20	20	2	20	15	18	20	20	20	6	2	10	20	20
5.—PIGS— (30 points)														
(a) Breed, Type, and Condition	10	...	...	...	...	9	...	...	9	...	...	...	...	...
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	20	20	20	20	10	15	27	10	15	20	20	30	20
(c) Housing, Feeding and Management	10	...	...	...	...	10	...	...	8	...	...	...	...	...
6.—FARM MANAGEMENT— (140 points)														
(a) Lay-out, Convenience, etc...	50	45	42	48	40	46	40	42	40	42	40	44	38	40
(b) Sanitation:														
(i) General	30	25	26	28	27	26	25	25	25	26	25	26	15	15
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	35	38	38	26	36	35	35	35	36	35	36	28	30
(c) Book-keeping and Records ...	20	14	14	17	15	15	12	15	15	14	14	12	16	12
7.—UTILISATION OF SKIM MILK— (50 points)														
Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	12	12	17	24	50	30	50	33	11	12	36	50	50
		829	810	810	769	762	736	718	701	698	665	665	613	590
Handicap		-10	- 5	- 15	- 1	...	...	...	...	...	...	...	...	...
Total	1000	819	805	795	768	762	736	718	701	698	665	665	613	590

TABLE 2.

POINTS GAINED BY COMPETITORS IN ZONE 2.

Centre: Wellington Agricultural Society, Bunbury. Judge: M. Cullity, Senior Agricultural Adviser.

	Max. Points.	Points Allotted.							
		A. Frost.	W. J. Sears.	L. Field.	R. J. Trigwell.	J. Hearman.	Flannagan Bros.	Norton Bros.	A. Trigwell.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)									
(a) Hay: Quality, Condition ...	60	50	55	46	46	45	48	46	50
(b) Silage: Quality, Type, Wastage, etc.	60	...	45	55	...	55	50	...	...
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	10	30	20	...	...	30	5	...
(d) Amount conserved per cow...	130	95	130	110	130	130	65	92	120
2.—PASTURES— (240 points)									
(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150	120	95	90	95	100	105	145	105
(b) Management, Fertilisation	90	70	75	80	75	70	75	70	75
3.—DAIRY HERD— (120 points)									
(a) Breeding and Dairy Type, including Butterfat Production per cow	60	55	48	52	48	40	39	43	60
(b) Condition and Freedom from Disease	30	29	30	30	27	27	25	25	30
(c) Herd Sire: (i) Pure-bred ...	20	18	17	18	17	17	18	17	17
(ii) *Ex* tested Dam	10	10	10	10	...	10	10	3	7
4.—RETURNS PER ACRE— (120 points)									
(a) Butterfat (lbs. per acre) ...	100	97	44	61	55	51	56	61	67
Sidelines: Pigs, Poultry Vegetables, etc. (per acre) ...	20	20	9	20	20	19	20	16	20
5.—PIGS (30 points)									
(a) Breed, Type, and Condition	10	8	8	8	8	7	8	8	4
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	10	5	4	10	5	4	3	...
(c) Housing, Feeding and Management	10	8	6	6	10	7	7	8	6
6.—FARM MANAGEMENT— (140 points)									
(a) Lay-out, Convenience, etc...	50	38	40	35	42	35	41	35	20
(b) Sanitation:									
(i) General	30	28	28	22	29	28	28	26	20
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	33	31	25	32	35	37	31	25
(c) Book-keeping and Records ...	20	18	15	14	12	15	20	20	12
7.—UTILISATION OF SKIM MILK— (50 points)									
Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	34	16	26	50	8	14	28	24
		751	737	732	706	704	700	682	682
Handicap	...	1	...	...	...	...	10	...	5
Total	1000	750	737	732	706	704	690	682	677

TABLE 3.

POINTS GAINED BY COMPETITORS IN ZONE 3.

Centre: Margaret River Agricultural Society. Judge: H. G. Elliott, Agricultural Adviser, Dairy Branch.

	Max. Points.	Points Allotted. E. C. McIville.	H. Eddy.	J. H. Oldfield.	A. Millar.	H. W. Lillingburst.	C. H. Ironmonger.	C. Taylor.	J. Angel.	W. Key.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)										
(a) Hay: Quality, Condition ...	60	53	47	52	50	49	44	44	44	46
(b) Silage: Quality, Type, Wastage, etc.	60	50†	85*	54	48	40†	40	70*	30	50
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	44		42	40	37	33		30	38
(d) Amount conserved per Cow	130	130	117	130	130	130	130	110	130	130
2.—PASTURES— (240 points)										
(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150	130	128	115	125	117	126	126	120	105
(b) Management, Fertilisation	90	78	72	80	80	65	70	75	70	60
3.—DAIRY HERD— (120 points)										
(a) Breeding and Dairy Type, including Butterfat Production per cow	60	55	50	46	45	49	56	42	38	44
(b) Condition and Freedom from Disease	30	28	28	25	28	26	27	27	24	25
(c) Herd Sire: (i) Pure-bred ...	20	19	17	18	18	19	20	17	17	10
(ii) *Ex* tested Dam	10	9	7	...	10	4	4	...	...	...
4.—RETURNS PER ACRE— (120 points)										
(a) Butterfat (per acre) ...	100	50	100	67	77	78	85	85	73	85
Sidelines: Pigs, Poultry Vegetables, etc. (per acre) ...	20	8	6	5	7	6	20	5	6	5
5.—PIGS— (30 points)										
(a) Breed, Type, and Condition	10	8	8	9	9	7	10‡	8	8	8
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	5	6	4	2	5		4	10	6
(c) Housing, Feeding and Management	10	6	5	9	7	7		9	8	7
6.—FARM MANAGEMENT— (150 points)										
(a) Lay-out, Convenience, etc ...	50	41	33	46	39	38	33	39	34	33
(b) Sanitation: (i) General	30	25	24	26	23	23	20	21	22	20
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	33	33	35	32	30	27	29	30	30
(c) Book-keeping and Records ...	20	15	13	13	12	11	10	14	14	10
7.—UTILISATION OF SKIM MILK— (50 points) Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	33	37	33	20	25	15	22	37	13
		830	822	809	805	766	770	747	745	720
Handicap		...	...	...	— 15	...	— 10	...	...	...
Total	1,000	830	822	809	790	766	760	747	745	720

* No silage or summer fodders, but ample summer pastures. † No silage but good summer pastures and fodders. ‡ Pure bred calves reared—only one pig kept.

Illustration 2.—A stack of silage and a stack of meadow hay cut from the same area by Messrs. Bayley Bros., Denmark. Silage is cut in early October; hay cut in late November. Fertiliser:—1 bag of superphosphate in February, 1 cwt. superphosphate end of July, also 40 lbs. superphosphate and 20 lbs. sulphate of ammonia immediately after cutting silage.

Illustration 3.—Maize grown by Mr. L. C. Field, Lowden. Mr. Field's herd of 19 cows averaged 258 lbs of butter fat. Maize is an excellent base on which to build a ration, and should be supplemented by meadow hay or cow peas.

TABLE 4.

POINTS GAINED BY COMPETITORS IN ZONE 4.

Centre: Bridgetown Agricultural Society. Judge: M. Cullity, Senior Agricultural Adviser.

	Max. Points.	Points Allotted.						
		S. C. Maidment	A. Tomerini.	T. Giblett.	H. F. Kendal.	G. E. White.	F. O. Nelson.	T. W. Stevenson.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)								
(a) Hay: Quality, Condition ...	60	55	50	45	46	47	47	52
(b) Silage: Quality, Type, Wastage, etc.	60	55	55	50	52	53	..	...
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	...	30	15	15	...	...	..
(d) Amount conserved per cow...	130	...	...	...	...	...	...	...
2.—PASTURES— (240 points)								
(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150	85	110	90	90	100	100	130
(b) Management, Fertilisation	90	80	65	75	70	70	70	6
3.—DAIRY HERD— (120 points)								
(a) Breeding and Dairy Type, including Butterfat Production per cow	60	58	54	54	45	45	.0	4.
(b) Condition and Freedom from Disease	30	25	26	24	25	26	27	20
(c) Herd Sire: (i) Pure-bred ...	20	16	18	16	18	18	18	16
(ii) *Ex* tested Dam	10	...	10	10	10	10	10	..
4.—RETURNS PER ACRE— (120 points)								
(a) Butterfat (lbs. per acre) ...	100	44	59	36	31	50	41	55
Sidelines: Pigs, Poultry Vegetables, etc. (per acre) ...	20	10	8	10	10	11	6	6
5.—PIGS— (30 points)								
(a) Breed, Type, and Condition	10	8	8	...	8	9	10	...
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	7	2	...	...	10	7	..
(c) Housing, Feeding and Management	10	8	5	5	6	7	8	6
6.—FARM MANAGEMENT— (140 points)								
(a) Lay-out, Convenience, etc...	50	35	35	40	38	39	45	37
(b) Sanitation:								
(i) General	30	28	25	30	27	27	30	28
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	25	28	30	25	32	35	30
(c) Book-keeping and Records ...	20	14	13	15	14	14	13	13
7.—UTILISATION OF SKIM MILK— (50 points) Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	23	13	17	20	19	20	13
Handicap		...	...	...	675 — 10	652 —5	...	...
Total	1,000	709	696	680	665	647	642	590

TABLE 5.

POINTS GAINED BY COMPETITORS IN ZONE 5.

Centre: Manjimup Agricultural Society. Judge: H. S. Rogers, Dairy Supervisor, Dairy Branch.

	Max. Points.	Points Allotted.													
		H. C. Barnsby.	J. Daubney.	A. G. Abbott.	H. Brown.	W. Grimshaw.	F. McKitchie.	J. W. Pratt.	B. Young.	G. Willis.	F. Bean.	J. T. N. Downes.	L. A. Preston.	G. Jackson.	J. Cooper.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)															
(a) Hay: Quality, Condition ...	60	45	53	36	39	53	59	52	56	57	44	48	43	40	56
(b) Silage: Quality, Type, Wastage, etc.	60	56	52	54	44	49	48	56	55	...	51	52	55	42	52
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	42	48	27	43	10	16	34	...	30	...	...	...	...	...
(d) Amount conserved per cow...	130	130	130	130	78	120	72	109	93	114	62	99	104	99	73
2.—PASTURES— (240 points)															
(a) Condition, Freedom from Weeds, Mixture, Drought-resistance, etc.	150	124	123	119	112	116	140	115	117	118	110	113	110	116	114
(b) Management, Fertilisation	90	78	57	56	58	65	62	54	55	64	67	55	58	56	38
3.—DAIRY HERD— (120 points)															
(a) Breeding and Dairy Type, including Butterfat Production per cow	60	54	46	56	51	45	49	44	55	50	49	45	52	51	50
(b) Condition and Freedom from Disease	30	26	24	24	24	24	24	22	28	23	25	21	23	24	24
(c) Herd Sire: (i) Pure-bred ...	20	19	13	20	19	17	19	14	19	14	14	18	18	19	17
(ii) *Ex* tested Dam	10	10	...	10	10	...	...	...	...	...	...	10	10	...	10
4.—RETURNS PER ACRE— (120 points)															
(a) Butterfat (lbs. per acre) ...	100	68	55	33	53	59	35	35	53	47	100	50	28	29	28
Sidelines: Pigs, Poultry Vegetables, etc. (per acre) ...	20	19	4	3	6	9	5	6	6	2	9	2	2	4	5
5.—PIGS— (40 points)															
(a) Breed, Type, and Condition	10	9	8	8	8	9	8	8	8	7	8	8	5	9	8
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	9	7	4	9	4	6	4	4	7	3	2	3	4	6
(c) Housing, Feeding and Management	10	9	8	8	8	4	8	7	7	8	6	5	6	8	8
6.—FARM MANAGEMENT— (140 points)															
(a) Lay-out, Convenience, etc...	50	40	32	46	39	33	40	30	29	39	29	32	34	33	35
(b) Sanitation:															
(i) General	30	26	23	25	25	23	26	24	20	25	21	25	25	24	23
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	32	28	34	35	31	35	30	27	33	30	32	32	30	31
(c) Book-keeping and Records...	20	19	4	15	20	6	13	14	15	15	8	12	7	6	8
7.—UTILISATION OF SKIM MILK— (50 points)															
Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	50	12	16	22	25	33	26	19	11	17	8	10	10	22
		865	727	724	703	700	698	684	666	664	653	637	626	614	608
Handicap		-15	...	-5	-1	...	...	...	...	...	...	...	...	...	...
Total	1,000	850	727	719	702	700	698	684	666	664	653	637	626	614	608

ZONE 6—CONTROLLED BY NARROGIN AGRICULTURAL SOCIETY.

This Zone (see map) embraces land lying either side of the Great Southern Railway from approximately Northam to Mount Barker, the rainfall varying from 17 to 25 inches.

Whilst this district primarily is suitable undoubtedly for the growing of oats and the rearing of sheep, the production of butter fat has increased consistently since 1929, and has more than doubled during the last three years. Moreover, it appears that dairy farming is likely to remain an adjunct to the system of farming throughout the area, even if prices of wool and sheep should increase in the future.

As there is little doubt that one of the most important factors for success with all stock raising activities in this zone is fodder conservation, and as farms in this zone also could not be judged on similar lines to farms in other zones, the committee decided to continue the special competition inaugurated in 1933, designed specifically to encourage fodder conservation, judging being conducted according to the following scale of points:—

Fodder conserved per head of dairy cows	50 points
Use of phosphatic licks	25 „
Silage or summer fodder crops	100 „
Hay—Condition and quality	50 „
Sanitation of dairy premises	25 „
Total	250 points

Those farmers occupying winning positions in the competition in 1934 were handicapped as follows:—

First prize winner	Deduct 5 points
Second prize winner	Deduct 3 points
Third prize winner	Deduct 1 point

TABLE 6.

POINTS GAINED BY COMPETITORS IN ZONE 6.

Centre—Narrogin Agricultural Society. Judge—H. G. Elliott, Agricultural Adviser, Dairy Branch.

Competitor.	Handicap.	*Fodder Conserved per Head. (50)	Hay—Quality and Condition. (50)	Silage (100)	Summer Fodder Crops. (100)	Use of Phosphatic Lick. (25)	Sanitation of Dairy Premises. (25)	Total Points. (250)
W. G. Burges	—5	50	46	96	...	25	25	237
J. A. Hardie & Son ...	—1	50	49	...	82	25	23	227
D. Bradford	...	48	44	85	...	25	18	220
Mrs. C. G. Whitford ...	...	50	44	48	40	22	15	219
R. McDougall	...	50	42	...	70	25	19	206

* Fodder conserved per head based on a conservation of 2½ tons of hay and 2 tons of silage or green material per cow.

Where both silage and fodder crops are provided, the scale of points to be halved in these sections, so that the total remains 100.

The winner, Mr. W. G. Burges, pins his faith for fodder conservation on silage to supply succulent feed during the dry months. In this instance the quality of the silage was excellent, there being scarcely any waste in the 200 tons conserved by means of concrete overhead silos, and one small underground silo. Some other competitors preferred to grow Sudan grass to replace silage, to provide succulence, but it is believed that the provision of silage is attended with less risk of a failure in case of weather vagaries.

Table 7 (p. 127) shows the comparison of the fodder conserved by the competitors in low rainfall areas, such as the Great Southern, with that conserved by farmers in wetter areas. It will be noted that the conservation in the "dry" areas is at least three times that in the "wet" areas.

TABLE 7.

FODDER RESERVES PER COW IN GREAT SOUTHERN DISTRICTS COMPARED WITH AVERAGE FOR SOUTH-WEST ZONES.

	Fodder Reserves per Cow.								
	Hay.			Silage.			Total Reserve, Calculated as Hay.*		
	1934-35.	1933-34.	1932-33.	1934-35.	1933-34.	1932-33.	1934-35.	1933-34.	1932-33.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Zone 6	4·45	4·9	2·9	3·25	2·8	3·3	5·53	5·83	4·00
Other Zones	1·43	1·49	1·21	0·84	0·89	1·16	1·72	1·79	1·60

* 1 ton Hay = 3 tons Silage.

TABLE 8.

POINTS GAINED BY COMPETITORS IN ZONE 7.

Centre: Denmark Agricultural Society. Judge: V. A. Caxton, Dairy Supervisor, Dairy Branch.

	Max. Points.	Points Allotted.				
		J. J. Daly.	F. C. Smith.	Bayley Bros.	P. Berridge.	L. L. Hargraves.
1.—CONSERVATION OF FODDER AND SUMMER FODDER CROPS— (300 points)						
(a) Hay: Quality, Condition ...	60	40	50	55	55	40
(b) Silage: Quality, Type, Wastage, etc.	60	...	45	50	40	50
(c) Summer Fodder Crops: Cultivation, Disease, Yield ...	50	45	40	...	30	
(d) Amount conserved per cow...	130	120	130	120	115	110
2.—PASTURES— (240 points)						
(a) Condition. Freedom from Weeds. Mixture, Drought-resistance, etc.	150	125	125	125	100	130
(b) Management, Fertilisation	90	60	50	60	50	50
3.—DAIRY HERD— (120 points)						
(a) Breeding and Dairy Type, including Butterfat Production per cow	60	30	50	55	40	45
(b) Condition and Freedom from Disease	30	25	25	25	20	23
(c) Herd Sire: (i) Pure-bred ...	20	20	20	20	20	20
(ii) *Ex* tested Dam	10	10	10	10	10	10
4.—RETURNS PER ACRE— (120 points)						
(a) Butterfat (per acre) ...	100	90	70	65	100	80
Sidelines: Pigs, Poultry, Vegetables, etc. (per acre) ...	20	20	8	6	10	8
5.—PIGS— (30 points)						
(a) Breed, Type, and Condition	10	7	8	8	8	6
(b) No. of Breeding Sows in proportion to Milch Cows ...	10	8	3	...	7	5
(c) Housing, Feeding and Management	10	6	7	8	7	5
6.—FARM MANAGEMENT— (140 points)						
(a) Lay-out, Convenience, etc...	50	35	40	45	30	35
(b) Sanitation:						
(i) General	30	25	22	25	20	20
(ii) Milking Shed, Dairy, Dairy Utensils, and care of Cream and Milk ...	40	30	30	35	25	35
(c) Book-keeping and Records...	20	12	12	18	15	10
7.—UTILISATION OF SKIM MILK— (50 points)						
Based on number of pigs reared and calf-months per cow ... (5 months—1 calf—1 pig)	50	50	25	10	31	21
Handicap		818 — 15	775 ...	740 ..	733 — 10	703 ..
Total	1,000	803	775	740	723	703

LESSONS FROM THE COMPETITION.

The Better Dairying Competition has now been conducted for four years, and along similar lines, the only alteration in the points for judging being that each year rather more stress has been laid on those sections dealing with the food of the herd, namely, fodder conservation, pasture production, and summer fodder crops.

Illustration 4.—Oaten hay, A. C. Frost, Donnybrook. This crop is of special value to supplement sparse growth of clover during autumn months, and as a corrective to pure clover pasture during spring months.

During this period no less than 257 farms have been visited and the system of farming carefully studied by officers of the Dairy Branch, Department of Agriculture. The information which has been gained should be a reliable guide to those wishing to embark on dairying in Western Australia, as the investigations each year have been remarkably consistent in indicating such factors as carrying capacity, butterfat per acre, conserved fodder per cow, etc.

I.—Conservation of Fodder and Summer Crops.

The object of the Committee of the Australian Dairy Council in initiating this competition was primarily to further the production of permanent pasture, but realising that the area of land at present cleared and suitable for pasture was small, especially in the older established districts, and that with the special climatic difficulties ruling in this State, that permanent pasture in the true sense of the words could not reasonably be expected for some years to come, the goal of adequate conservation of fodder for the dry summer months was set, the aim being to have at least 2½ tons of hay or its equivalent available for each milking cow in the herd.

The average conservation this year shows an increase of 30 per cent. over that in 1932, when the competition was initiated, and the number of farmers that have reached the objective, increases each year, but owing to new entrants the average conservation during the last two years has remained constant. This result is valuable and gratifying.

Table 9 below illustrates this, and also clearly shows the great leeway between the leading competitors in each zone and the average conservation for the whole area. In studying these results it must be borne in mind that all farms would be above the average for the State.

TABLE 9.

TOTAL FODDER CONSERVED PER COW.

	Total Cows.	Hay.	Silage.	Reserve per Cow.		Reserve per Cow, calculated as Hay.*
				Hay.	Silage.	
	(1)	(2)	(3)	(4)	(5)	(6)
	No.	tons.	tons.	tons.	tons.	tons.
Zone 1 (Harvey). Average ...	533	351	121	0·66	0·23	0·73
S. F. Russell	36	74	...	2·00	...	2·00
Zone 2 (Bunbury)	246	416	187	1·69	0·76	1·94
W. J. Sears	34	110	25	3·24	0·74	3·49
Zone 3 (Margaret River) ...	208	600	209	2·9	1·0	3·13
J. Oldfield	21	70	95	3·3	4·5	4·8
Zone 4 (Bridgetown)	161	220	237	1·36	1·47	1·85
H. E. Kendall	23	48	28	2·1	1·1	3·47
Zone 5 (Manjimup)	301	489	343	1·60	1·13	2·0
J. Daubney	17	49	24	2·90	1·4	3·4
Zone 7 (Denmark)	101	155	210	1·53	2·08	2·23
F. C. Smith	13	40	54	3·0	4·1	4 37
Average all Zones, 1934-35 ...	1,550	2,232	1,307	1·43	0·84	1·72
1933-34	1,633	2,447	1,432	1·49	0·89	1·79
1932-33	1,531	1,854	1,784	1·21	1·16	1·60
1931-32	1,502	1,605	931	1·06	0·71	1·23

* 1 ton Hay = 3 tons Silage = 3 tons Green Fodder.

Column 6 in Table 9 shows that the average fodder conserved this year was 1.72 tons reckoned as hay, which is the same as that for last year, but 30 per cent. higher than when the competition commenced. Last year the farms in only two zones averaged two tons per cow, but this year three zones exceed this figure, while one, namely Bunbury, equals this figure. The entrants in the Margaret River area in particular are to be congratulated on the very high average shown; it is the only zone to exceed the goal of 2½ tons of conserved fodder per cow, the figure being 3.13 tons per cow.

It is surprising that the practice of making silage from clover has not spread to a greater extent, but the season in 1934 at silage cutting time was unsuitable as little rain fell during September, causing the clover pasturages to be short, and not conducive to heavy cuts necessary for making silage. By hay cutting time, however, rains had fallen and the growth was good.

Silage cutting is performed before the regular hay season commences, and can be carried on almost regardless of the weather, as rain will not harm silage. By this means more of the annual pasture plants can be saved in the nutritious stage before maturity, while this is not possible where a large area has to be cut for hay, as the plants ripen very quickly once the warm weather has arrived. It is believed that silage making must eventually be routine practice on every dairy farm where irrigation water is not available.

Columns 4 and 5 show that the quantity of hay conserved per cow is almost twice that of silage, and when one remembers that the dry matter in hay is approximately three times that in silage by weight, the quantity of silage becomes very small, only the equivalent of 1/3 ton per cow, or the product of 1/12th acre of an average subterranean clover crop.

TABLE 10.

COMPARISON OF FODDER CONSERVED PER COW, 1931-32 TO 1934-35.

Zone.	Reserve per Cow.								Total Reserve, calculated as Hay.*			
	Hay.				Silage.							
	1934-5	1933-4	1932-3	1931-2	1934-5	1933-4	1932-3	1931-2	1934-5	1933-4	1932-3	1931-2
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
1. Harvey	0·66	1·23	0·92	0·76	0·23	0·51	1·00	0·24	0·73	1·40	1·25	0·84
2. Bunbury	1·69	1·19	1·02	0·40	0·76	0·54	0·50	0·40	1·94	1·34	1·19	0·53
3. Margaret River ...	2·90	1·79	1·38	1·12	1·00	0·82	1·14	0·90	3·13	2·06	1·76	1·42
4. Bridgetown ...	1·36	1·60	0·94	1·23	1·47	0·80	0·81	0·75	1·85	1·87	1·21	1·48
5. Manjimup... ...	1·60	2·10	1·58	1·53	1·13	2·10	2·29	0·71	2·00	2·80	2·37	1·76
7. Denmark	1·53	1·20	2·11	1·62	2·08	1·20	2·20	0·71	2·23	1·60	2·66	1·86
Average, all Zones ...	1·43	1·49	1·21	1·06	0·84	0·89	1·16	0·74	1·72	1·79	1·60	1·33

* 1 ton Hay = 3 tons Silage.

Illustration 5.—Mr. J. Daubney, Manjimup, aims at conserving at least 2½ tons of fodder per cow, and accomplishes this by a combination of good quality hay, clover silage and maize crops.

QUALITY OF HAY.

Except in Zone 1 (Harvey) and Zone 6 (Narrogin), the quality of meadow hay generally was not equal to that of last year. This was directly as the result of the continued wet weather during November, whereby it was necessary to turn the hay on more than one occasion during curing.

In Zone 1, embracing the area from Armadale to Brunswick, the average conservation of hay was low, being only .66 tons per acre. The Judge, Mr. C. Giles, commented that, as all competitors had a certain area of pasture which could be irrigated, too great a reliance was placed on irrigation supplying ample green fodder during the summer months. On such farms the summer and early autumn months are usually good growing periods, but it is noted that, during autumn and early winter when the average irrigated pastures are not thriving, stock often experience a lean time. This period would be from June to August, and it is for these months that conservation is necessary.

Table 10 shows that, except in Zone 1, the conservation of fodder, particularly hay, has increased considerably during the last four years. This increase, however, has generally been in the direction of increasing the quantity of hay conserved, except in the Bridgetown district (Zone 4) where the conservation of silage has increased from ¾ of a ton to 1½ tons per cow. It is noticeable also that, as far as Grade Herd Recording results show, and also the reports of judges on the present competition, it is in this area that the highest producing grade herds in the State are found.

The writer believes that the example of these individual competitors is being followed by the surrounding farmers in each district, and, as will be shown later, the number of herds with productions exceeding 250 lb. per cow increases each year as the quantity of conserved fodder increases.

In those districts where irrigation is impossible or where a long dry summer is invariably to be expected, the importance of ample fodder conservation is fully realised by farmers—more so than by those farmers who are fortunate enough to be situated in districts with summer rainfall or where irrigation water is available. This is well shown in Table 11 below, where the average farm inspected in the Narrogin Zone showed a total conservation of 5.53 tons hay per cow in comparison with an average of 1.72 tons in dairying districts proper. This may be in part due to the use of larger machinery on such farms, which equipment is required in conjunction with activities in farming these large areas which are at least 1,000 acres. Dairy farming is, therefore, a sideline but a profitable one where such quantities of fodder can be reserved.

Table 11.

FODDER CONSERVED PER COW IN WET DISTRICTS COMPARED WITH THAT IN DRY AREAS.

Zone.	Hay.	Silage.	Total Reserves per Cow, calculated as Hay.
	tons.	tons.	tons.
Average—All Zones in Wet Districts	1·43	0·84	1·72
„ Zone 6 (Narrogin)	4·45	3·25	5·53

Zones 1–5 and 7 receive 30ins. to 60ins. rainfall.

Zone 6 only receives 17ins. to 25ins. rainfall.

GREEN SUMMER FODDER CROPS.

Table 12 sets out the area per milch cow sown with fodder crops in each of the seven zones:—

TABLE 12.

ACREAGE OF GREEN FODDER PER COW.

Zone.	Summer Fodders.	Acres Sown per Cow.
	acres.	
1. Harvey	143.0	0·26
2. Bunbury	9·5	0·04
3. Margaret River	33·0	0·16
4. Bridgetown	10·5	0·07
5. Manjimup	32·5	0·11
7. Denmark	35·5	0·35
Total	264·0	0·17
6. Narrogin	75·0	1·00

It will be noted that the area sown is almost negligible, being an average of only 0.17 acres per milking cow.

This area, with a green crop of average yield per acre, and which has been shown in experiments and other competitions to be approximately 10 tons per acre, would supply sufficient green material for one cow for only three months, without allowing for any wastage. As the bulk of the hay conserved should be used during the late autumn and winter months, sufficient silage should have been conserved for at least two months of the summer period. The average silage conserved, however, being only 0.84 tons per cow, was sufficient to feed a cow for less than one month. In view of this, it is difficult to understand, where silage was not, or could not have been conserved, why a larger area of summer fodder crops were not grown.

It is further anomalous that the farmers growing the larger areas of summer crops are also those conserving the larger tonnages of hay and silage. Farmers in Zone I. (Harvey), where the conservation of hay and silage was low, have compensated for this in part by larger areas of summer crops, sufficient to supply green fodder to their cows for approximately four months, which, in conjunction with irrigation, proved ample provision.

Table 13 shows that during the last four years the growing of fodder crops has not shown much improvement, except in Zone I. (Harvey), where the area has increased threefold. In other districts the area sown has remained constant, and therefore very low.

TABLE 13.

ACREAGE OF GREEN FODDER GROWN PER COW.

Zone.	1931–32.	1932–33.	1933–34.	1934–35.
1. Harvey	0·09	0·19	0·29	0·26
2. Bunbury	0·08	0·04	0·04	0·04
3. Margaret River	0·12	0·14	0·09	0·16
4. Bridgetown	0·14	0·02	0·001	0·07
5. Manjimup	0·13	0·14	0·130	0·11
6. Narrogin	...	1·56	1·00	1·00
7. Denmark	0·32	0·38	0·550	0·35
Total	0·14	0·127	0·141	0·17

Apart from the work entailed in thorough cultivation, another reason for the unpopularity of these summer crops seems to be the general impression that heavy applications of expensive fertilisers are necessary to ensure success.

It is not uncommon to find such crops as maize sown with expensive fertiliser mixtures, with dressings per acre ranging from 4 to 8 cwt. Maize variety trials and fertiliser trials carried out by the Department of Agriculture over a number of years indicate that such dressings are uneconomical, and that where heavy yields have been so obtained the cost is excessive. The most economical dressing for such summer crops is 3 cwt. of superphosphate and ammonia No. 3 per acre. For those desirous of mixing their own fertilisers, this fertiliser consists of superphosphate, 2½ parts, and sulphate of ammonia, 1 part.

Illustration 6.—A good crop of maize grown by Mr. J. Daubney, second prize winner in Manjimup Zone. In this zone, where the areas of farms are small, it is essential to grow the equivalent of half an acre per cow of some summer fodder crop.

The varying success obtained in the growing of summer crops undoubtedly is due to lack of thorough cultivation of the soil, and, where farmers feel they are unable to give the land the cultivation thought necessary, they would be well advised to desist wasting money on seed and expensive fertilisers—this latter necessity, however, is rather a reflection on capacity for crop husbandry.

One of the special needs for dairy stock during the summer months is an adequate supply of protein nutrients obtainable usually as clover hay or clover silage, the latter for preference. Very promising results have been obtained during the last three years from the growing of cow peas (*Vigna sinensis*) and it is believed that this crop will prove a valuable means of supplementing silage as a source of protein during the summer months.

Failures which have been reported have been due mainly to two factors:—

(a) The sowing of the seed, especially on "new" soil, without first inoculating the seed with the special strain of soil bacteria necessary for the healthy growth of this particular legume. Cultures of these bacteria may be obtained from the Department of Agriculture, the cost being 1s. 6d. per tube, post free.

(b) The sowing of the seeds too early in the season, before the soil is sufficiently warm. Although numerous summer growing leguminous crops have been experimented with in this State from time to time, so far the Cow Pea offers the brightest prospects.

PASTURE PRODUCTION.

The reports of judges definitely indicate that in all districts the care of pasture is receiving more attention from farmers. In areas where, owing to the dry summer and lack of irrigation, a true pasture is not to be expected, the growing period, however, is being lengthened by two practices, both of which are to be recommended—

(1) Harrowing of all pasture areas before or immediately after the first rains, with a view to not only spreading seed and providing a little mulch to assist in germination, but particularly to break up and evenly distribute clods of manure.

It has been noted that where pastures are harrowed even without fertiliser being applied, a definite improvement is apparent than if such cultivation is neglected. The application of superphosphate, however, should not be omitted if possible, and in very few instances is this fertiliser not applied. Early application is recommended, if possible before the harrowing.

(2) Even on non-irrigation areas there is a general move to lengthen the growing period by the incorporation of drought-resistant species or annual grasses with a longer growing period than subterranean clover. Those grasses which have given promising returns are Italian Rye grass and Phalaris tuberosa.

PASTURE IN IRRIGATION AREAS.

With the development of the irrigation areas at Waroona, Harvey, and Brunswick, a keen interest is being evinced in the development of permanent pasture, and the most economical methods by which this may be established.

Where the area to be sown has previously grown subterranean clover for a number of years, and can be irrigated, very promising returns have been given by mixtures of perennial rye grass and white clover. Spring sowing has been successful, particularly where the Lucerne Flea (*Smynthuris viridis*) or Red-legged Earth Mite (*Halotydaeus destructor*) are prevalent, as where white clover is sown during autumn, failures have resulted from the attacks of these pests. With subsequent years of irrigation, however, it has been found that the attacks from Lucerne Flea are not serious.

On land where the fertility is low, paspalum and white clover are recommended for sowing in the spring.

The incorporation of grasses in pasture and also the maintenance of a short sward, particularly where subterranean clover dominates the pasture, will result in lessening the undesirable feed flavours in cream.

DAIRY HERD MANAGEMENT AND BUTTER FAT PRODUCTION.

One thousand five hundred and fifty cows were milked by competitors during the year, the average production being 192.7 lbs. butter fat per cow. This does not compare favourably with the average production for 1933-34 which was 208.8 lb., or for 1932-33 which was 201.5 lb. This is due, however, to a high per-

centage of new entries to the competition, and it is confidently expected that, should these farmers continue to enter the competition or study the results obtained by the leading competitors and endeavour to put these into operation, their average yields also will increase rapidly. This is borne out by the fact that the leading herds in production generally are owned by those farmers who

Illustration 7.—Mr. W. J. Sears, Donnybrook. The use of a "tumbler sweep" for collecting clover for silage is quicker and less laborious than loading up to a cart.

have entered the competition on other occasions. Whereas only 6 herds in 1932-33 produced more than 250 lb. butter fat per cow, during the present year no less than 18 herds exceeded this high production figure. In the names of the owners of these herds given below in Table 14, a number of previous competitors will be recognised.

Table 14.

Owner.	No. of Cows in Herd.	Production of Butter Fat per Cow.
		lb.
H. Eddy, Forest Grove	15	373·0
G. E. Scott, Yarloop	26	348·0
A. Trigwell, Donnybrook	20	340·0
F. C. Smith, Denmark	13	337·0
W. Shaw, Harvey	50	326·6
A. Tomerini, Balingup	23	321·0
A. Frost, Donnybrook	17	289·0
Bayley Bros., Denmark	20	283·0
T. Giblett, Bridgetown	11	275·0
A. Blackburn, Harvey	28	272·0
S. F. Russell, Serpentine	36	272·0
S. C. Maidment, Balingup	22	271·0
S. Bowers, Brunswick	31	269·2
C. H. Ironmonger, Wonnerup	24	261·2
F. O. Nelson, Balingup	32	259·0
L. Field, Donnybrook	19	258·0
W. J. Sears, Donnybrook	34	258·0
H. C. Barnsby, Pemberton	16	253·2
Total, 18 Herds	437	5266·2
Average	27·2	292·8

The average herd owned by these 18 farmers comprises 27 cows with an average production of 292.8 lb. butter fat per cow.

Mr. H. Eddy, of Forest Grove, whose herd was the highest producing herd in 1932-33, still maintains pride of position, as his 15 cows average 373 lb. butter fat per cow.

Table 15 below shows the percentage of bulls, according to breed, owned by competitors. Practically all competitors own pure bred bulls, and the judges remark that there is a distinct improvement in the average type of herd during the last four years. This, of course, is not entirely due to the Better Dairying Competition, but is an indication of the general uplift which is taking place throughout the dairying districts in Western Australia with a view to reducing the cost of production of butter fat to as low a figure as possible.

It will be seen in Table 15 that the three breeds recommended by the Department of Agriculture, and the studs of which have been entered by their owners under the Pure Breeds Herd Recording Scheme, comprise 98.4 per cent. of the dairy bulls in use by competitors, the three breeds being the Jersey, Australian Illawarra Shorthorn, and the Guernsey.

TABLE 15.

THE PERCENTAGE OF BULLS IN USE, ACCORDING TO BREED.

Breed.	1932–33.	1933–34.	1934–35.
	%	%	%
Jersey	66·0	57·5	57·1
Guernsey	18·0	17·5	25·4
A.I.S.	11·0	15·0	15·9
Ayrshire	5·0	5·0	1·6
Friesian	...	5·0	...
Total	100·0	100·0	100·0

The following Table 16 shows the average production of cows in each Zone together with that of the highest producing herd. It will be seen that the average production for each area—except the Manjimup area—was well over 200 lb. butter fat per cow, which figure is considered necessary for the profitable production of butter fat at 1s. per lb.

TABLE 16.

AVERAGE PRODUCTION PER COW IN EACH ZONE, TOGETHER WITH THAT OF THE HIGHEST PRODUCING HERD.

Zone.	Number of Cows.	Average Cows in Herd.	Average Butter Fat per Cow.
		No.	lb.
1. Harvey	533	41	216·3
G. E. Scott, Yarloop	...	26	348·0
2. Bunbury	246	29·5	230·0
A. Trigwell, Donnybrook	...	18·5	340·0
3. Margaret River	208	23·1	221·5
H. Eddy, Forest Grove	...	15·0	373·0
4. Bridgetown	161	21·9	244·6
A. Tomerini, Balingup	...	20·66	321·0
5. Manjimup	301	21·5	176·3
H. C. Barnsby, Pemberton	...	16·0	253·2
7. Denmark	101	20·2	256·8
F. C. Smith, Denmark	...	13·0	337·0

The herd of 26 cows owned by Mr. G. E. Scott, Yarloop, is the leading herd in Zone 1 with an average production of 348 lb. butter fat. Mr. Scott is a Guernsey breeder, his herd being comprised of pure bred Guernsey and Guernsey cross cows.

The herd owned by Mr. A. Trigwell, of Donnybrook, whose 18 cows have averaged 340 lb. butter fat, is an outstanding example of the value of a definite policy in the use of pure bred sires ex tested dams, as, although his herd contains few pure bred cows, by consistent breeding the herd gives one the impression of being pure bred from the point of view of type, and a high production standard has been maintained for a number of years.

Mr. H. Eddy's herd at Forest Grove, which has averaged 373 lb. butter fat, is a Jersey-Guernsey crossbred herd, the cows being large framed and carefully selected for production, as Mr. Eddy has tested his cows privately for a number of years. These cows also have the advantage of approximately 18 acres of excellent permanent pasture consisting mainly of lotus major.

Mr. A. Tomerini, Balingup, whose 20 Jersey cows averaged 321 lb. butter fat, which is the highest average production for the Bridgetown Zone, has the distinction of producing the most butter fat per acre, namely 59.2 lb., the average for the zone being 42.9 lb. This is also the highest for all zones.

Mr. H. C. Barnsby, Pemberton, who has been in the competition since 1931, is to be congratulated on again having the highest average production for the Manjimup Zone, namely 253 lb. butter fat per cow from 16 cows. Mr. Barnsby did not purchase any concentrates for his herd, the fodder for which is all produced on the property.

Mr. F. C. Smith, at Denmark, has the excellent average of 337 lb. butter fat per cow from 13 cows. Here also special mention should be made that practically no concentrates are purchased, but reliance is placed on ample fodder conservation, particularly silage and the growing of summer crops.

It will be noted that all these herds, except one, had an average well over 300 lb. butter fat per cow.

Illustration 8.—Economic handling of subterranean clover for the production of silage on Mr. W. J. Sears' property, Donnybrook.

BUTTER FAT PER ACRE.

Table 17 sets out the average production of butter fat per acre for each zone and also the average for the leading farm in each of the zones.

TABLE 17.

AVERAGE PRODUCTION OF BUTTER FAT PER ACRE IN EACH ZONE COMPARED WITH THAT OF THE LEADING COMPETITOR.

Zone.	Acres devoted to Dairying per Farm.	Average No. of Cows per Herd.	Butter Fat per Acre.			
			1934-35.	1933-34.	1932-33.	1931-32.
1. Harvey	189·0	41	47·01	61·6	34·8	53·4
W. Shaw	200·0	50	81·6	...	...	...
2. Bunbury	117·6	29·5	57·7	32·8	46·6	50·4
A. Frost	41·0	17	97·5	...	...	...
3. Margaret River	93·5	23·1	54·9	46·6	43·6	37·9
H. Eddy	75·0	15·0	74·6	...	...	...
4. Bridgetown	125·0	21·9	42·9	35·7	40·7	35·1
A. Tomerini	112·0	23·0	59·2	...	...	...
5. Manjimup	77·4	21·5	49·0	46·0	38·8	35·5
H. C. Barnsby ...	68·0	16·0	70·7	...	...	...
7. Denmark	89·2	20·2	58·1	70·0	49·4	45·4
J. J. Daly	110·0	30·0	64·5	...	...	...
Average, all Zones	118·6	27·7	48·6	43·8	42·6	43·0
Average, 6 leading Farms ...	101·0	25·2	72·8	48·6	54·0	49·0

It will be seen from the above Table 17 that, whereas the average return of butter fat per acre was constant during the first three years of the competition, the average has now increased by approximately 5 lb. per acre. This is due to a slight increase in the size of herds from 24 cows in 1931 to 28 cows in 1935. The increase in the size of the herd, however, if these additional cows were producing the same amount per head as each cow in the herd previously, should have accounted for a larger increase per acre.

Moreover, it will be noted that, where the average production of butter fat per acre is high, it is on those farms which are below the average in area. In other words, these smaller farms are fully stocked and probably are returning their maximum under rather better than average management conditions. The only exception to this statement is the farm owned by Mr. A. Frost, at Donnybrook, where 17 cows are maintained on 41 acres with an average return of 97.5 lb. per acre. Mr. Frost is to be congratulated on the production figures, but he has an advantage over other farmers on dry areas, as there are several acres of very rich paspalum and white clover pasture running through the centre of his property, which is equivalent to an irrigation area during the summer months.

Mr. H. C. Barnsby in Zone 5, who has a return of 71 lb. butter fat per acre, is running 16 cows on 68 acres, which is probably the maximum number of cows that this area will carry profitably.

In Zone 7 (Denmark) the average size of the holding developed for dairying at present is 89 acres, and previous experience has shown that the present stocking of 20 milking cows is as much as can reasonably be carried on this area. It will be seen that the butter fat production of 58 lb. per acre is above the average for all zones, viz., 48 lb.

It appears, therefore, from the results shown by the competition during the last four years, that a dairy farm should not be smaller in area than 120 acres which, when fully developed, will support approximately 30 cows with good management.

The highest production per acre was obtained by Mr. G. E. Scott, of Yarloop, whose farm of 74 acres gave a return of 122 lb. butter fat per acre.

It is interesting to note that, in the report of the Royal Commission on the Dairying Industry in New Zealand in 1934, the Commission there believe that, unless dairy farmers obtain a return of 120 lb. butter fat per acre under New Zealand conditions, it is doubtful whether the business would be a profitable one.

Mr. Scott's farm, however, has the advantage of irrigation during the summer months.

ACRES UTILISED PER MILKING COW.

In ascertaining the number of acres necessary to support a milking cow, provision must be made for the attendant heifers, and dairy sire, also horses. It is estimated that a farm supporting 20 milking cows, or a 20-cow unit farm, will comprise 50 stock as set out below. In this estimate allowance is made for 10 per cent. losses in all young stock, which is a liberal allowance.

Stock on Farm Supporting 20 Milking Cows.

20	Cows.
9	Heifers 2 years old.
9	Heifers—Yearling.
9	Heifer Calves.
1	Bull.
2	Horses.
Total 50	

Table 18 shows the number of acres utilised per milking cow for each year that the competition has been in operation.

TABLE 18.

ACRES UTILISED PER DAIRY COW.

Zone.	Average No. of Cows in Herd.				Acres devoted to Dairying.				Acres per Cow.			
	1934–5	1933–4	1932–3	1931–2	1934–5	1933–4	1932–3	1931–2	1934–5	1933–4	1932–3	1931–2
1. Harvey	41·0	35·7	31·7	31·7	189·0	123·8	150·7	138·9	4·46	3·6	4·8	4·4
2. Bunbury	29·5	36·0	42·2	43·5	117·6	244·7	207·5	247·7	3·80	6·8	4·6	5·1
3. Margaret River ...	23·1	21·3	20·6	19·0	93·5	91·0	88·8	81·5	4·00	5·8	4·3	4·3
4. Bridgetown ...	21·9	25·6	23·3	17·6	125·0	134·4	117·4	96·1	5·40	5·3	4·4	5·5
5. Manjimup ...	21·5	21·8	23·2	17·1	77·4	85·3	118·1	92·4	3·60	4·2	5·1	5·7
7. Denmark	20·2	18·5	19·0	13·7	89·2	55·0	85·1	57·4	4·40	3·0	4·5	4·2
Average, all Zones ...	27·7	26·3	25·5	23·7	118·6	126·7	120·6	119·0	4·14	4·7	4·7	4·9

It will thus be seen from the above Table 18 that, although a milking cow required 4.14 acres during the last year, the actual carrying capacity of the average farm on a per head basis was 1.65 acres.

It also will be seen from this table that the size of the herd has gradually increased each year from 24 to 28 cows, whilst the average area devoted to dairying has remained approximately constant.

The greatest increase in the size of the herd has been in Zone 1, but here also an increased area has been devoted to dairying, which has resulted in maintaining the same average stock-carrying capacity of each farm. In 1933-34 the stock carrying capacity in this zone was increased, but it is believed that this resulted in overstocking.

In Zone 2 the herds have been considerably reduced during the last 4 years, but also the area devoted to dairying. This reduction in the herds, however, has been due to culling, as most of the farmers who entered the competition are in one of the grade herd recording units. The culling has resulted in a higher butter fat production throughout the area. It is believed, however, that there is some over-stocking in this area, as only 3.8 acres have been allowed for a cow unit.

Illustration 9.—Round silage stacks are less wasteful than square or oblong ones. A 100-ton stack being built by Mr. W. C. Forrest, "Beechborough," Wonnerup.

In Zone 5 (Manjimup) the herds have remained practically constant, while there has been a decrease in the area actually being utilised, with the result that the area allowed for each cow unit is only 3.6 acres, and the indications are that this is not sufficient for high butter fat production. This is well illustrated in Table 16 where the average production per cow in this zone is only 176 lb. However, the leading farmer, Mr. H. C. Barnsby, who allowed over 4 acres per cow, had an average production of 253 lb. butter fat per cow. It appears dangerous, therefore, to allow for a stocking capacity of more than 1 cow to 4-4½ acres on farms where irrigation is not available.

PIGS.

It is particularly pleasing to note that the tendency for dairy farmers to deplete the number of pigs on their holdings has been overcome, and that there is distinct evidence that farmers are endeavouring to restock their farms with breeding sows. For the first three years of the competition the number of sows in comparison with the number of cows decreased each year. During this year, however, as is shown in Table 19 below, the stocking up has taken place, particularly in those areas where the greatest depletion had occurred during the previous three years.

Table 19.

COMPARISON OF NUMBER OF SOWS TO COWS.

Zone.	No. of Cows.	No. of Sows.	No. of Cows to 1 Sow. 1934–35.	1933–34.
1.—Harvey	533	18	23·6	34·5
2.—Bunbury	246	24	10·2	10·7
3.—Margaret River	208	30	6·9	15·9
4.—Bridgetown	161	14	10·9	11·2
5.—Manjimup	301	26	11·6	10·6
7.—Denmark	101	12	8·4	12·3
All Zones—1934–35 ...	1,550	124	12·5	...
1933–34	1,633	115	14·2	...
1932–33	1,531	144	10·7	...
1931–32	*950	141	6·7	...

* Whole milk suppliers excluded.

The above table shows that in Zone 1 (Harvey) where a considerable quantity of whole milk is produced for the metropolitan market, the number of pigs carried in 1934 was extremely low, namely, only 1 sow to 34 cows. During the past year, however, this number has been increased by 50 per cent., namely, 1 sow to 23 cows.

In Zone 3 (Margaret River), where the depletion had been most severe during 1933-34, namely, only 1 sow to 16 cows, the number of breeding sows has been more than doubled during 1934-35, *i.e.*, 1 sow to 7 cows.

In the Denmark area (Zone 7) there has been an increase of 50 per cent. in the number of breeding sows carried, namely, from 1 sow to 12 cows to 1 sow to 8 cows.

As pointed out during 1933 and 1934, when the prices of pig products were low, with careful management—even at the low prices then ruling—profits could be made, as instanced by a number of competitors. It is probable, however, that under average farm conditions there was little profit during the latter period of 1933 and the first half of 1934 in pig products in districts far removed from bacon factories. Even so, farmers were strongly advised to maintain their breeding sows, although their actual breeding activities might be curtailed.

Experience has shown that it is not a sound policy to sell or slaughter breeding sows as they can be maintained very cheaply, and the price cycle for pig products according to European investigations is from 2 to 3 years.

It is estimated that the revenue from pigs averages approximately £2 per cow, though this figure is considerably exceeded by certain competitors. This return has been rather bettered by farmers in the competition, as the average sales of pigs were 29 per farm where 27 cows were milked. During the year porkers or baconers would have averaged more than 40s. per head, at which figure the return would be more than £2 per cow. Experience has shown that one breeding sow can be profitably carried on a dairy farm to each 4 to 5 cows.

Although Table 19 shows that there is a tendency to increase the number of breeding sows carried, it is apparent that this avenue of production and revenue at present is seriously neglected throughout the dairying districts.

Table 20 below shows the breeds of sows owned by competitors during the last 3 years.

TABLE 20.

BREEDS OF PIGS OWNED BY COMPETITORS.

No. of Sows.			Per Cent.			Breed of Sow.
1934–35.	1933–34.	1932–33.	1934–35.	1933–34.	1932–33.	
26	35	70	21	30	49	Berkshire.
75	61	55	61	53	38	Berkshire × Tamworth.
3	1	6	2	1	4	Middle White.
2	2	4	2	2	3	Middle White × Berkshire.
9	6	2	7	5	1	Large White.
9	10	7	7	9	5	Other Breeds.
124	115	144	100	100	100	

It will be seen that the Berkshire and Tamworth and their crosses are undoubtedly the most favoured breeds.

The Department of Agriculture in 1930 strongly advised farmers to carry only the Tamworth and Berkshire breeds, as it was believed from the experience which could be gathered from leading breeders and curers throughout the State that these two breeds would supply the carcases required for pork and bacon both locally and overseas, and, moreover, were particularly suited to West Australian farming and climatic conditions. It will be seen that last year 82 per cent. of the breeding sows owned by farmers were of those two breeds.

The result of the Perpetual Trustees' Export Trophy for bacon and pork pigs last year shows that the Department's recommendation in 1930 was justified, as pigs bred from the Tamworth and Berkshire on the average gained the highest points from local judges and also from Smithfield experts who submitted a report from England on the carcases.

From the foregoing, increased attention to pig-raising in dairying districts is strongly advocated.

Illustration 10.—Sows grazing on clover at Sabina Vale Stud Farm, Wonnerup. Under these conditions, the cost of keeping sows is very small, and they should not be sold during periods of low prices for bacon.

COST OF FERTILISERS.

Owing to the almost universal absence of available phosphoric acid in West Australian soils, farmers now make it a routine practice to apply dressings of a phosphatic fertiliser, generally superphosphate, to all crops, including pasture land, each year. It is valuable, therefore, in endeavouring to arrive at the cost of producing dairy produce that some reliable figure for the average expenditure on such fertiliser should be available. This information is given for each zone in Table 21.

Table 21.

QUANTITY AND COST OF FERTILISER FOR PRODUCTION OF BUTTER FAT.

Zone.	1lb. Fertiliser used per lb. of Butter Fat produced.	Average Superphosphates applied (1lb. per acre).	Total Expenditure for Fertiliser per acre.	Cost of Fertiliser per lb. of Butter Fat.
			s.	d.
1.—Harvey	4·15	195	7·394	1·888
2.—Bunbury	3·6	169	6·408	1·638
3.—Margaret River ...	3·9	221	8·342	1·774
4.—Bridgetown	3·4	123	4·659	1·547
5.—Manjimup	3·1	153	5·801	1·410
7.—Denmark	4·9	259	9·858	2·229
Average all Zones ...	3·7 lbs.	179·8 lbs.	6·66s.	1·683d.

It will be seen in column 2 that the average application of superphosphate per acre varies from 123 lb. in Zone 4, at Bridgetown, to 259 lb. in Zone 7, Denmark, the average application for all farms being 179 lb.

In column 1 it is shown that the pounds of fertiliser for each pound of butter fat produced varies from 3.1 lb. in Zone 5 (Manjimup) to 4.9 lb. in Zone 7 (Denmark). The cost of such fertiliser in column 4 is shown to vary from 1.41d. to 2.23d. per lb. of butter fat, the average for all farms being 1.68d.

It will be seen that in the Denmark Zone, where the area devoted to dairying is small, the cost of fertiliser is relatively high. This heavy application is justified on small holdings, as carrying capacity must be raised as much as possible in order to meet overhead expenses, which are generally approximately the same as on holdings of larger area.

In Zone 5 (Manjimup), where the area devoted to dairying was also small, the very low relative application of superphosphate is undoubtedly the reason why the average butter fat production in the area is so low, i.e., 176 lb. per cow. The position in this area also was accentuated by reason of over-stocking.

In calculating the cost of fertiliser, no allowance has been made for freight from works to farm.

CLOSER SETTLEMENT.

It is believed that the South-West portion of the State, with its heavy annual rainfall—and also the recent development of an area of country approximately 50 miles long by 4 to 5 miles wide for irrigation—offers great scope for closer settlement. This area is suitable for dairy farming in particular, and all branches of mixed farming.

As indicating the possible carrying capacity of such farms, figures were obtained this year giving the average number of persons carried on each dairy farm or on an area of approximately 120 acres. One would expect that Zone 1, embracing

the irrigation area mentioned above, would carry the densest population, and investigations show that the number of persons supported on each farm was 6.4 in this zone, while the number carried on the average farm in the competition was 5.6, or approximately one person to every 21 acres.

Illustration 11.—Tobacco is a "side-line" on Mr. N. C. Barnsby's property, Manjimup. Side-lines, however, may become unprofitable if allowed to interfere with the main sources of revenue on a dairy farm, butter fat and pig production.

SUMMARY.

1. Interest in permanent pasture production has increased during the year, particularly in the irrigation areas.

2. On dry areas, the grazing period may be lengthened by the incorporation of grasses with a longer growing period than subterranean clover, such as Italian rye grass, Phalaris tuberosa.

3. In irrigation areas, on "new" land, paspalum and white clover are recommended. On special fertile land, perennial rye grass and white clover have given good results.

4. The importance of the conservation of fodder cannot be over-stressed, and more fodder should be conserved, particularly in irrigation areas, where conservation should be in the form of hay.

5. On "dry" farms increased conservation of silage is strongly recommended.

6. The average conservation in all zones is 1.71 tons of hay, which is approximately the same as for the previous year. The goal of $2\frac{1}{2}$ tons of hay per milch cow is still considered as desirable.

7. There has been an increase in the area sown to summer fodder crops, but on the average the area should be at least double that sown during 1935 so as to supplement silage conserved.

8. The average production of the 1,550 cows in the competition was 192.7 lb. butter fat. As these cows have been maintained on farms considered to be above the average for the dairying districts, the estimated production of the average cow in the South-Western portion of the State is believed to be approximately 180 lb. butter fat per lactation period.

9. Eighteen herds produced more than 250 lb. butter fat per cow, compared with six herds in 1932-33.

10. The production of butter fat per acre increased by approximately 5 lb. per acre over that of previous years, being 48.6 lb. per acre. This figure, however, is probably slightly inflated to what may be looked for on the average dairy farm, by reason of the fact that a number of farms in Zone 7 and in Zone 1 were small in area and probably fully stocked.

The average figure of 43 lb. butter fat per acre for the previous 3 years probably will be reverted to in the 1936 Competition.

11. The average herd in the Competition has increassed to approximately 28 cows, which has maintained the tendency shown each year for herds to become larger. This increase in the size of herd, however, to be on sound lines, must be accompanied by an increase in the area devoted to dairying.

12. The average dairy farm comprises 118·6 acres, which is a reduction in area for farms entered in the Competition in 1933-34, but still indicates that 100 to 120 acres should be the minimum for an economic dairy farm.

13. The area required to carry a milking cow is 4.1 acres, compared with 4.7 for the three previous years.

As mentioned above, and during the course of the above report, it is believed that certain areas are overstocked to the detriment of production and that 4.5 acres is probably a correct average figure for the area required to maintain a cow. This, of course, is for "dry" farms.

14. During the year there has been an endeavour to increase the avenues of revenue on the dairy farm. Care should be taken that these avenues are not increased at the expense of legitimate butter fat production. Avenues such as egg production, potato-growing, vegetable-growing, are limited in scope and should not be so developed as to interfere with butter fat and pig production.

15. As pointed out in 1934, pig-raising had fallen to a dangerously low ebb, and even breeding sows had been disposed of throughout dairying areas. There is a tendency now for pig-raising to be increased and the number of breeding sows has been increased from 1 sow to 14 cows to 1 sow to 12 cows. It is believed that 1 sow to 5 cows will prove profitable.

16. The use of phosphatic licks is general throughout the summer months, while in the Northcliffe and Denmark areas a phosphatic lick which also contains limonite (oxide of iron) has given remarkably good results.

17. By reason of the very comprehensive information which is required by the judges, whereas during the first competition great difficulty was obtained in securing information owing to the general absence of any system of records on farms, it is pleasing to record that, not only amongst competitors but amongst dairy farmers generally, a more or less complete record of the operations of the farm is now being kept.

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ERRATA.

September, 1934, No. 3, Volume 11, page 454—"Determination of Age in the Horse." Figures 2 and 3 should be transposed, figure 2 being an illustration of a three-year-old mouth and figure 3 being an illustration of a two-year-old mouth.

March, 1935, Volume 12, No. 1, page 17—"Herd Testing, 1934-35."
"Kudardup Bluebell, 2926," owned by Mr. A. G. Haynes, Nornalup, should have been placed in the Junior 3-year-old class and not in the Senior 3-year-old class.

NOTES ON THE HARVESTING AND GRADING OF SUBTERRANEAN CLOVER SEED AT DWALGANUP, BOYUP BROOK, W.A.

G. SLATER, Seed Inspector.

Although subterranean clover (*Trifolium subterranean* Linn.) has been grown in Western Australia for over forty years, coming into prominence between the years 1914 and 1917, great advancement has been made during the last few years in the methods of harvesting the seed, due mainly to the efforts of Mr. P. D. Forrest, of Dwalganup, Boyup Brook, who has the distinction of having discovered the extra early variety which now bears the name of his homestead—Dwalganup.

This article is mainly concerned with the harvesting and cleaning of the seed, but a few preliminary facts regarding the sowing will not be out of place.

The ground most suitable for the growing of heavy crops of subterranean clover is of a light sandy nature, and any soil with a tendency to cake or harden on the surface adversely affects the yield. At Dwalganup the best crops are obtained from virgin country which has been simply cross cultivated without ploughing. A cover crop of oats, together with 3-5 lbs. of clover seed per acre is sown during or about the month of June. One cwt. of superphosphate per acre is mixed and applied with the seed which is broadcasted. Though not essential, the cover crop, in addition to providing material for hay, appears to aid the establishment of the subterranean clover. The hay is cut in the usual way, the stubble fired, and the clover is allowed to thicken for a season. Even two seasons are sometimes necessary to obtain a good stand.

After this time, the clover now being thick and well established, seeds and dries off, and a fire is run through the paddock to clean the surface of the ground, the burnt matter, large sticks and stones being removed by hand raking. As

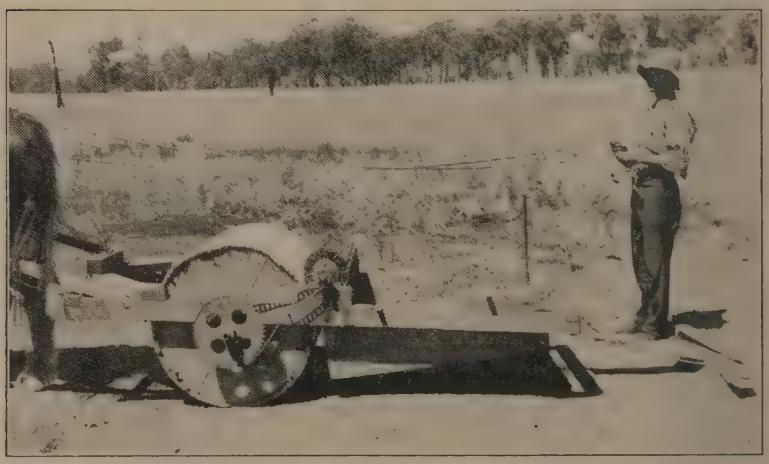

Fig. 1.—This type of roller is capable of gathering a comparatively clean sample of "burr."

by far the greater proportion of the burr is from one-quarter of an inch to two inches below the surface of the ground, extremely little is destroyed or damaged by the fire.

Pasture harrows or the like are now drawn over the cleaned ground, thus breaking up the top layer of soil and exposing the burr ready for collection by a special machine designed and patented by Mr. Forrest. This extremely simple but wonderfully effective implement consists of four main parts, viz., a rectangular frame of 3in. x 2in. Oregon approximately 10 feet by 3 feet 6 inches, a built-up wooden roller or drum 3 feet long and 2 feet 6 inches in diameter, a circular wire or brass brush 3 feet long and 9 inches in diameter driven by chain and sprocket at approximately four times the speed of the drum, and a loose box, open at the top and 12 inches deep, filling the remainder of the frame. The roller is covered with a sheep-skin showing 1 inch to 1½ inch staple, and the brush is set to revolve just sufficiently near to the skin to brush or flick off the burr, and at the same time tease up the wool. In operation the machine is drawn by a horse, shafts being provided for the purpose, and a set of light scarifiers attached to the rear cross member of the frame. The wool on the roller picks up the burr which is whisked off by the revolving brush into the box underneath. These machines cover the same area three or four times, or until there is not sufficient burr left in the ground to make the operation profitable.

Fig. 2.—Gathering "burr" by means of rollers at Dwalganup.

Depots in the paddock are provided with a large wire mesh table or screen on to which the filled boxes of burr are tipped. The woven wire used on these tables is of a size which allows sand, grit, etc., to fall through, thus preventing trouble in later stages of cleaning the seed, the burr remaining on top of the screen.

After passing over the table, the burr is fed to a dehulling machine, the active principle of which is a pair of heavy jarrah rollers covered with woven wire which revolve against concaves of the same material at a fast speed. Both seeds and waste material, after having been disintegrated by the teasing action of the rollers, pass through the concaves, and in falling, the seed, being the heavier, drops on to a wide chute up which a strong current of air is blowing.

This current is provided by a large bladed fan, the speed of which is adjusted to blow the waste material from the machine, and permit the seed to slide down the chute, from the bottom of which it is elevated into bags. It can be readily understood that this draught must be very carefully adjusted, otherwise either seed will be lost in the "blow away," or waste material will be permitted to enter the bag of seed.

Except in very hot weather, many of the smaller seeds still retain their outer coat or pod, which is removed in a similar machine, the only difference being that bullock hide is substituted for woven wire on the rollers and concaves. A considerable amount of handling would be saved by combining these two operations in one composite machine, and this combined treatment will probably be adopted shortly.

Though now comparatively clean and free of outer coverings, the seed varies very considerably in size, so to obtain a uniform finished product, it is put through a grader of the "Clipper" type. This grader contains two shaking screens, one showing circular holes of 7/64th inch diameter, the other and finer screen having slits 5/16th inch x 3 64th inch. The seed first passes through the larger screen which removes exceptionally large seeds to constitute a super grade. Passing over the finer screen the small seeds and dust are eliminated, and the residue, thus graded to size, falls off the edge of the screen to meet a regulated blast of air which prevents the lighter weight seeds (though of the same size) from falling to the foot of the grain elevator, as do the seeds of correct weight. The uniformly sized and weighted seeds are taken from the elevator into double sacks and sewn, constituting a product known as First Grade Seed, and having a purity of 96-97 per cent., while the lighter weight seeds removed by the blast in the grader are bagged and sold as F.A.Q. grade.

Yet another simple but effective machine is occasionally used at Dwalganup, this being a gravity grader for removing grit, etc., from seed. It consists of a built-up frame holding two sheets of glass at an angle (which can be varied) of approximately 30 degrees to the horizontal plane. Though set in a parallel plane, the rear or top edge of the lower sheet is placed about three inches away from, and a similar distance below, the front edge of the upper sheet, thus leaving a gap between the sheets which is provided with a chute. A similar gap is formed at the bottom of the lower sheet by the clean seed receptacle being placed below and away from it. The seed to be cleaned is fed from adjustable small holes in an overhead hopper, the principle being that the rounded seeds bounce down the glass into the bottom receptacle, jumping the gaps en route, while the sharp-cornered, irregular pieces of grit, sticks, etc., tend to remain in close contact with the glass, so sliding down, falling into the gaps, and away down the chutes.

It yet remains for a machine to be evolved of the type of the wheat harvester which will gather the burr and clean the seed in one operation ready for the grader, but its cost would probably only be justified on holdings where a large quantity of seed is grown for selling purposes.

M. T. PADBURY TROPHY COMPETITION.

I. Thomas,
Superintendent of Wheat Farms.

A further year's results are available for the above competition, which has now been conducted for a period of five years, viz., 1930-34 inclusive.

This competition was inaugurated in 1930 as the result of a generous donation made by Mr. M. T. Padbury, a pioneer farmer of the Moora district, and will cover a period of ten years, i.e., the final year will be in 1939.

The trophy is a handsome shield, and each year a replica is made and presented to the winner for that year. This minor trophy was won for the past season by Messrs. F. M. & J. L. Atkins, of Jouerdine, via Lake Brown, who obtained the splendid average of 4 bushels 29 lbs. per inch of rainfall over an area of 371 acres.

These farmers were also successful in 1931 with an average yield of 3 bushels 0 lbs. per inch, and in 1933 with a yield of 3 bushels 39 lbs. Last year's figure of 4 bushels 29 lbs. constitutes an official record for this State, breaking the winners' own record of the previous year of 3 bushels 39 lbs. per inch of growing period rain.

The conditions under which this competition is conducted are as follow:—

1. The competition will commence with the 1930-31 harvest and continue for a period of 10 years. At the end of that period the trophy will be awarded to the competitor who has taken part in the competition for at least five years, and who obtains the greatest mean average acre yield per inch of rainfall during the conventional growing period. The mean average yield will be computed from the results of the five seasons in which the competitor produced the highest acre-yield per inch of rainfall during the growing period. In the event of a tie the competition will continue between the leading competitors until an advantage is gained by one of them.

2. The conventional growing period for any year will be that decided upon and announced by the Royal Agricultural Society. For the first year, and until further notice, it has been decided that it will be from May 1st to October 31st, inclusive.

3. Until the end of the competition the trophy will be in the custody of the Royal Agricultural Society, and will be displayed at any agricultural exhibition held by that society.

4. Each year the competitor who obtains the best average acre yield per inch of rainfall during the conventional growing period will be awarded a replica of the trophy. His name will also be inscribed upon a small shield affixed to the trophy.

5. The rainfall upon which the award will be made will be determined by the Commonwealth Meteorologist from the district records, and his decision in this matter will be final.

6. The competition will be limited to those farmers who harvest at least 200 acres of wheat for grain. Where a competitor is financially interested in the crops grown on one or more farms, he will be required to supply details regarding the production and marketing of the crops on same, and, though usually the award will be made upon the results from the farm nominated by the competitor, yet the Royal Agricultural Society may require that the crops on these farms be included in the competing area.

7. The average yield will be ascertained from the total area—including self-sown crops—harvested for grain, and determined from the actual amount of wheat sold, as shown by the delivery dockets, plus the amount retained for seed, for home use or for any other purpose.

8. The method of judging will be as follows:—At a convenient time the area harvested for grain will be measured and the quantity of wheat on hand ascertained. On or before January 31st the farmer will be required to furnish the judge with a sworn declaration as to the quantity of wheat sold from the competing holding or holdings, and the amount retained for seed and other purposes; the statement regarding the amount sold to be supported by agent's dockets. The judge, after satisfying himself as to the correctness of this statement, will compute the average yield per acre per inch of rainfall during the growing period from the information received.

9. The judge will be appointed by the Director of Agriculture, and his decision will be final.

10. Nominations for this competition will be received by the Royal Agricultural Society up to the 31st October each year.

The results for 1934 are as follow:—

M. T. PADBURY TROPHY COMPETITION.
RESULTS FOR 1934-35.

Competitor.	Address.	Rainfall during Growing Period.	Area Harvested.	Yield.					
				Gross.		Average per Acre.		Average per 1in. Growing Period Rain.	
		points.	acres.	bus.	lbs.	bus.	lbs.	bus.	lbs.
Atkins, F. M. & J. H.	Lake Brown ...	420	371·0	6,981	0	18	49	4	29
Nottage, R. B. ...	Tammin	683	260·0	7,484	0	28	47	4	13
Butcher, O. J. ...	Pithara	672	514·0	14,282	47	27	47	4	8
Smith, C. & Sons ...	Yarding	620	1,533·0	37,618	54	24	32	3	57
Currie, J. J.	Bruce Rock ...	660	243·5	6,207	41	25	30	3	52
Rudduck, S. A. ...	Coorow	790	200·0	5,643	0	28	13	3	34
Prowse, E. W. ...	Doodlakine ...	575	430·0	7,960	39	18	31	3	13
Wegner, C. J. ...	Belka	746	503·75	11,943	13	23	43	3	11
Robins, G. E. & Co.	Babakin	765	503·0	12,184	32	24	13	3	10
Manuel, C. J.	Mukinbudin ...	518	681·5	10,822	0	15	53	3	4
Allen Bros.	Bruce Rock ...	711	547·0	11,704	8	21	24	3	1
Scadding, N. A. ...	Dornock	1,094	500·0	15,394	4	30	48	2	49
White, R. H.	Gnowangerup ...	1,073	282·0	8,417	0	29	51	2	47
Creagh Bros.	Nungardin ...	604	1,007·5	16,256	28	16	10	2	41
Bremner, J. R. & Sons	Corrigin	809	1,075·0	22,718	21	21	8	2	37
Snell, C. & Sons ...	Nungarin ...	609	320·0	5,102	54	15	57	2	37
Stewart, W. B. ...	Gnowangerup ...	1,073	200·0	5,360	39	26	48	2	30
Strange, P. A. ...	Yarding	716	264·0	4,380	26	16	36	2	19

"THE JOURNAL OF AGRICULTURE"

will be supplied free *on application* to any person in the State who is following Agricultural, Horticultural, or Viticultural pursuits, and to Agricultural Societies or Associations.

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Editors of Agricultural and Country papers are invited to reproduce any of the articles contained in this Journal, providing the usual acknowledgment is made.

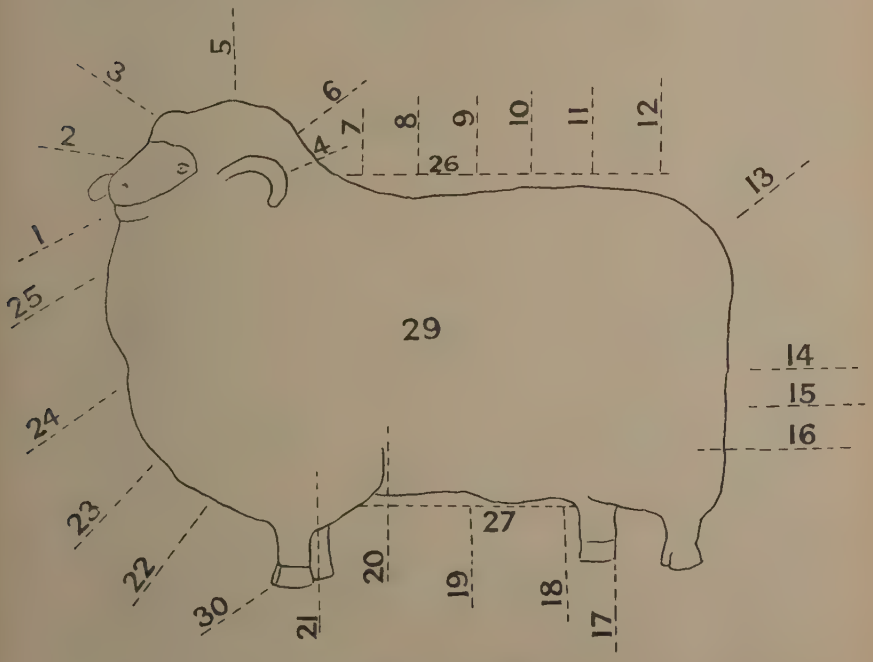
If you are not receiving the *Journal*, which is issued quarterly, and wish to do so, please forward your name and postal address to the Director of Agriculture, Perth.

GENERAL POINTS IN SELECTING A RAM.

By Hugh McCallum,
Sheep and Wool Inspector.

The important business of selecting suitable rams to mate with the ewes calls for attention. In doing this, the general character of the flock must be borne in mind and also the faults and blemishes that must be eradicated as far as possible in the next generation. To this end the rams purchased should be exceptionally strong in those points, where the ewes are faulty, otherwise the results will not be very satisfactory. Carefully observe the important points of good quality, pure breeding and good constitution. These qualities a ram must possess, along with as much style and finish as it is possible to obtain. It is on the ram that so much depends as regards the quality of the future stock. It is essential to examine closely the way the animal stands. Some rams stand square on their feet, but others are very faulty. Notice should be taken to see whether there is any inclination to weakness in the hocks and hind legs. Straight hocks and good action are outstanding points of a well-bred ram.

Below is a diagram of a ram, with the various points numbered and a short description added for what should be sought in purchasing a ram.



GENERAL POINTS.

1. *Bite.*

A sheep should have a good bite, not undershot or overshot. The term relates to the formation of the mouth of a sheep, undershot being a very objectionable fault as it interferes with the gathering and masticating of its food. In many in-

stances when sheep have this fault, it is generally transmitted to their offspring. Overshot is when the upper part of the mouth or jaw overlaps the lower, it is a fault more objectionable than undershot.

2. *Face.*

The head and face should be in proportion to the body, neither too long and large, nor too small. A pinched nose and small nostrils denote a weak constitution. Constitution is first and foremost. The lower part of the face should be well covered with short, fine, soft, velvety hair and free as possible from black spots.

3. *Forehead.*

The forehead should be broad and prominent with room between the eyes, to give an open and intelligent appearance.

4. *Horns.*

The horns should be well set, free from spots or streaks of black, with a regular curve, showing distinct and even corrugations, and not too close at their base or too close to the cheek.

5. *Crest.*

The crest should be correctly arched, covered with wool and free from bare patches at the base of the horns.

6. *Neck.*

The neck should be of moderate length, well rounded, muscular, fairly wide at the junction of the head, and enlarging gradually until joining the shoulders.

7. *Wither.*

The wither should be broad and fairly arched, a peaked wither is undesirable and such sheep are usually narrow in the chest.

8, 9, 10. *Back.*

The back should not be too long, but strong and well proportioned. Any indent behind the wither is a sign of weakness. It is necessary that a sheep should be full and wide around the girth.

11. *Loin and Hips.*

Should be wide and hips broad and level.

12. *Rump.*

The rump should be broad, hindquarters well rounded, but not drooping.

13. *Tail.*

The tail evenly set, broad and horseshoe shape at base.

14. *Twist.*

Should be slightly arched, but full.

15. *Flank.*

Outer flank.

16. *Hocks.*

Good hocks are necessary in sheep. Avoid sheep whose hind legs are close together and are noticed to rub one against the other or to curve inwards.

17. *Testicles.*

The testicles of the ram should be examined. Often testicles are enlarged and the movements of the animal are restricted because of the severe pain.

18. *Flank.*

Inner flank should be fairly full.

19. *Belly.*

Many sheep are lightwoolled on the belly. Avoid same.

20. *Arm.*
The arm should be large and behind the elbow there should not be too much bare skin.

21. *Shoulders.*
Should incline upwards and backwards.

22, 23, 24. *Folds.*
The folds of a sheep should appear massive, there being two or three folds, the bottom one the largest, appearing like an apron.

25. V-like shape at throat.

26. *Top line.*
Should be straight.

27. *Underline.*
Should be parallel with the ground.

28. *Conformation.*
It must be remembered that a ram with every point perfect will be rare, but as near as possible to the ideal should be obtained.

29. *Ribs.*
The ribs should be well sprung, slightly rounded on sides.

30. *Legs.*
Legs fairly straight, not over long, good bone. Hoofs should be amber coloured.

Wool.
The covering should be of the desired type that is required.

AGRICULTURAL PROBLEMS

Agriculturists, pastoralists and primary producers generally, who may be having difficulties of any kind in connection with their production activities, are invited to communicate with the Agricultural Adviser of their district of the Department of Agriculture, when information and advice will be supplied free of charge.

Where identification of plant or stock diseases or insect pests is required, full details of symptoms should be forwarded and also samples of the diseased plant, animal tissue or insect where practicable. Plant tissue intended for examination by the Plant Pathologist should be wrapped in paper and not forwarded in airtight containers, and plant specimens for the Botanist should be pressed between newspaper and dried before despatch. With regard to animal tissue for microscopic examination, this should be forwarded in a solution of 10 per cent. formalin, or if of considerable bulk in a sealed kerosene tin containing a few ounces of formalin as a preservative. Living insects should be sent in suitable containers and dead specimens in methylated spirits.

The addresses and names of Advisers are as follows:—Albany, A. C. Vaughan; Bridgetown, A. Flintoff; Bunbury, M. Cullity; Denmark, V. Cardon; Geraldton, G. L. Throssell, Government Buildings; Gosnells, R. C. Owen; Harvey, D. L. Breen (Fruit) and C. Giles (Dairying); Katanning, A. S. Wild; Manjimup, J. Ireland; Mundaring, V. Cahill; Northam, F. L. Shier; Northcliffe, A. Sharp; Vasse, J. M. Nelson.

ACCIDENTAL OVIPOSITION BY A SPECIES OF DRAGON FLY IN TOMATO FRUITS.

(*Aeschna brevistyla*, Rambur)

L. J. NEWMAN, F.R.E.S.,
Government Entomologist, Department of Agriculture.

C. F. H. JENKINS, B.A.
Assistant Entomologist, Department of Agriculture.

During early May, examples of tomato fruits into which insect eggs had been deposited were forwarded from Geraldton for determination as to the insect culprit responsible for the damage.

The eggs had been laid in more or less irregular rows, just under the skin of the fruit. The fact that eggs were laid there did not cause the fruits to rot, but rendered them unsightly, which, should the trouble become general, would greatly reduce the selling value. An examination of the eggs revealed that they were the ovum of a Dragonfly, and when incubated and hatched definitely confirmed our diagnosis.

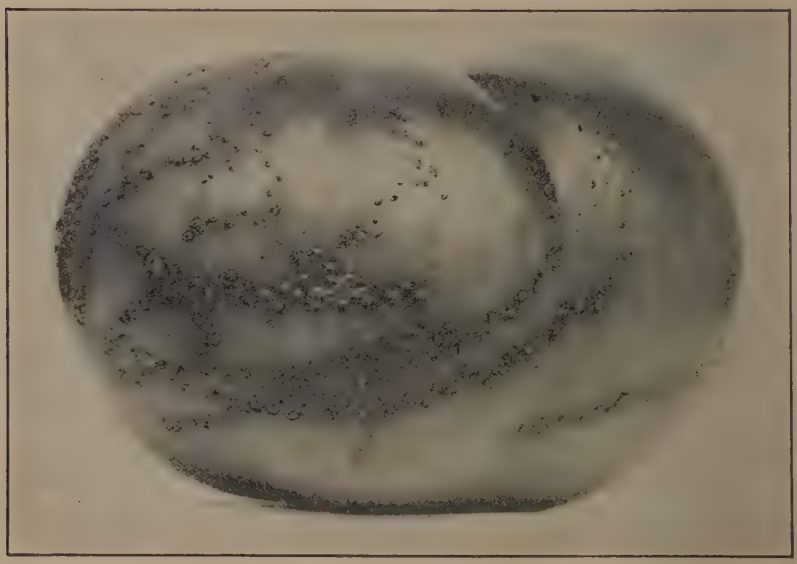


Fig. 1.
Tomato Fruit, showing typical appearance of damage caused by the act of laying. × 1½ (*Original*).

The early stages of dragonflies are passed in water, where they live as predators on aquatic insects and other living forms found there. After reaching the adult winged or aerial stage, they are still predators living upon various forms of flying insects, such as mosquitoes, gnats, etc., which they capture on the wing.

The eggs are laid in two ways, according to the species. Some deposit them into the tissue of plants which grow in or close to water, and others deposit them directly on to the surface of water or in other ways outside the tissue of plants.

Egg-laying into plants occurs in the case of those forms possessing an ovipositor, viz., all the *Zygoptera, Aeschninae, and Petalurinae*. The females make an incision in the tissues of plants in or near water and there deposit their eggs.

Fig. 2.
Egg from which pronymph is just issuing.
× 250 (*Original*).

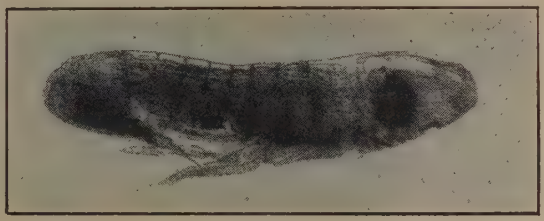


Fig. 3.
Pronymph as it emerged from egg and before it has left its pronymphal sheath. × 250 (*Original*).

Fig. 4.
Lava as hatched from egg found in Tomato Fruit.
× 200 (*Original*).

In the present instance, an unusual or what may be termed an accidental deposition of eggs has been made in tomato fruits.

In figure 1 each mark represents where an egg has been inserted; the eggs, which are elongated, are laid singly under the skin lengthwise. After three weeks or less the eggs hatch.

The pronymphal stage (fig. 3) only lasts for a few minutes as a rule, when the integument in which it is encased splits and the young aquatic larva appears.

The pronymph (Figure 3) in the present instance was capable of making slight jumping movements. The purpose of this is to enable it to reach water, where the larva emerges fully equipped for the struggle in life.

The rest of the pre-winged life is spent in water. If these eggs are laid, as in the present case, away from quick access to water, the resultant larvae will simply fall to the ground and die. So far as we are able to ascertain, the act of depositing eggs by a species of dragonfly in tomato fruits is unique and can be regarded as accidental. There is no reason to fear that this will become a serious trouble.

During the incubation of the eggs, a species of egg parasite belonging to the family *Mymaridae* issued.

Acknowledgments:—

Mr. K. Norris—loan of slide from which Figure 3 was prepared.

Mr. D. R. Smith—assistance in taking micro-photographs.

Dr. R. J. Tillyard—"The Biology of Dragonflies."

WHEAT AND OAT VARIETY TRIALS.

G. K. BARON-HAY,
Superintendent of Dairying.

These trials have been conducted for a number of years throughout the South-West by officers of the Dairy Branch and were continued during 1934.

Mr. C. Giles, Dairy Instructor, reports as follows on the trials conducted on farmers' properties:—

P. Hocart, Wokalup.

Soil: Brown clay loam.

Timber: Mostly bluegum.

Drainage: Insufficient.

Seeding: Rate, 2 bushels per acre oats, 1⅓ bushels wheat.

Fertiliser: Superphosphate 1 bag per acre.

Date of Seeding: 17th and 18th June.

The yields obtained were as follow:—

Green Material.

Variety.	Yield. T.	C.	Q.	LB.	Percentage Yield.
Algerian Oats (control)	2	3	0	24	100
Burt's Early Oats	3	16	0	0	177
Guyra Oats	1	8	3	7	68
Mulga Oats	3	17	3	2	182
Nabawa Wheat	1	8	3	7	68
Yandilla King Wheat	2	14	0	2	126

Growing conditions were unfavourable up to the end of September, the land being waterlogged continually. Earlier seeding, therefore, would have been advantageous.

A. S. Warburton, Brunswick Junction.

Soil: Clay loam.

Timber: Redgum and jarrah.

Drainage: Satisfactory.

Seeding: 2 bushels oats per acre, 1⅓ bushels wheat per acre.

Fertiliser: 1 cwt. superphosphate per acre.

Date of Seeding: 15th June.

Land previously carrying subterranean clover.

Green Weight.

Variety.	Yield. T.	C.	Q.	LB.	Percentage Yield.
Algerian Oats (control)	9	0	0	2	100
Gurt's Early Oats	8	12	3	8	96
Guyra Oats	9	7	0	24	104
Mulga Oats	10	8	3	8	116
Yandilla King Wheat	5	0	3	7	56
Nabawa Wheat	5	8	0	1	60

Heavy rains fell immediately after seeding, which probably affected germination. In this instance, also, earlier seeding would have been advantageous.

The red-legged earth mite attacked all varieties badly in the early stages of growth, and up to the beginning of September there was very little promise of obtaining satisfactory yields.

Mr. H. G. Elliott, Agricultural Adviser, reports as follows:—

Briggs Bros., Byford.

Soil: Grey sandy loam overlying clay.

Timber: Jarrah, redgum, and blackboy.

Drainage: Fair.

Seeding: 2 bushels oats, 1⅓ bushels wheat per acre.

Fertiliser: 1½ cwts. superphosphate per acre.

The yields were as follow:—

Green Weight.

Variety.	Yield. T.	C.	Q.	LB.	Percentage Yield.
Algerian Oats (control)	5	7	3	0	100
Burt's Early Oats	3	15	1	20	70
Guyra Oats	5	18	2	3	110
Mulga Oats	3	4	2	17	60
Yandilla King Wheat	3	4	2	17	60
Nabawa Wheat	3	11	3	9	66

The growing conditions throughout the season were not good, as, owing to the sandy nature of the land, this became waterlogged during the heavy winter rains.

Mr. V. L. Cardon, Dairy Supervisor, reports as follows:—

Denmark Experiment Farm.

Soil: Sandy.

Timber: Karri, jarrah.

Drainage: Good.

Seeding: 2 bushels oats, 1⅓ bushels wheat per acre.

Fertiliser: 1 bag superphosphate per acre.

Date of Seeding: 23rd July, 1934.

The yields obtained were as follow:—

Green Weight.

Variety.	Yield. T.	C.	Q.	LB.	Percentage Yield.
Algerian Oats (control)	2	6	2	19	100
Burt's Early Oats	4	6	2	19	185
Guyra Oats	5	0	2	0	215
Mulga Oats	2	10	0	0	106
Yandilla King Wheat	2	0	0	0	86
Nabawa Wheat	4	6	2	19	185

Owing to the late sowing, the crop made very little growth during the winter, but came away fairly well in the spring. The whole crop was very uneven.

From a feeding point of view, Burt's Early gave best results, as it had a fine stalk, good flag, and heavy head. The Guyra variety was very coarse and heavy in the stalk with small heads.

The average of the 32 trials conducted throughout the South-West is shown in the following table:—

Variety.	Yield. Average 96 plots. 32 Trials. T.	C.	Q.	LB.	Percentage Yield Hay.
Algerian Oats	2	6	1	0	100
Guyra Oats	2	2	3	2	94
Lachlan Oats *	2	2	0	7	91
Burt's Early Oats	1	15	2	0	78
Mulga Oats	1	9	0	0	63
Yandilla King Wheat †	1	8	3	11	62
Nabawa Wheat †	1	2	3	22	50

* Lachlan—20 plots only. † Yandilla King and Nabawa Wheat—12 plots only.

Observations.

From these results early seeding is specially desirable, *i.e.*, in May, prior to the first heavy rains.

The Algerian oats used for the control was stud seed obtained from one or other of the Department's Experiment Stations, and on the average has proved superior to the other varieties grown, all of which were obtained from the same source. For early feed the variety "Mulga" appears superior, and is more rapid in recovery after grazing than the variety "Burt's Early."

FIELD EXPERIMENTS ON LIGHT LAND AT GNOWANGERUP.

A. S. WILD, B.Sc. (Agric.),
Senior Agricultural Adviser.

The problem of light land development in the Gnowangerup district has led to a series of experiments with a view to determining whether economic crops of wheat can be grown on this class of soil.

During 1933 the trials included a time of planting experiment with both mid-season and late maturing varieties of wheat and also a rate of superphosphate experiment. The results of these have been published in the Journal of Agriculture (March, 1934, page 50).

Although the need for larger applications of superphosphate was apparent, the low yields obtained indicated that the low fertility was probably due primarily to a factor or factors not included in the scope of the experiment. Field obser-

vations, although not conclusive, appeared to indicate a nitrogen deficiency. A general deficiency of plant food such as phosphates, nitrogen and potash and also humus appeared to contribute to the low fertility, and accordingly experiments were planted during 1934 with a view to obtaining additional information.

These included a mixed fertiliser experiment where, in addition to superphosphate, sulphate of ammonia and potash were applied as fertilisers as follow:—

Plot 1.—112 lbs. sulphate of Ammonia.
150 lbs. Superphosphate.

Plot 2.—150 lbs. Superphosphate.

Plot 3.—112 lbs. Sulphate of Ammonia
150 lbs. Superphosphate.
56 lbs. Muriate of Potash.

The site of the experiments was on the property of Mr. R. M. Watterson, about four miles north of Gnowangerup, the soil being light sandplain which had originally carried mallee and scrub and had been cropped once previously. It was disc ploughed three inches deep during late July of 1933. It was then disced to a depth of two inches about the middle of August and again immediately before planting. The variety "Yandilla King" was planted on the 3rd of May in plots each half an acre in area, the treatments being as previously stated and the three plots duplicated.

The rainfall as registered at Gnowangerup during the year together with the average rainfall is given below:—

		Growing Period										Total for
Year.	Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Year.
1934	62	4	616	120	177	261	260	161	108	106	1073	75	28	1978
Average 20 years to 1932	56	82	88	158	227	223	232	193	178	148	1201	67	71	1723

The yields of the plots were as hereunder:—

Planted 3rd May, 1934. Variety—"Yandilla King." Rate of Seed—45lbs. per Acre.

Fertiliser per Acre.	Computed Yields per Acre. Section 1. Bus.	lbs.	Section 2. Bus.	lbs.	Average Bus.	lbs.	Percentage Yields. %
112lbs. Sulphate of Ammonia ... ... } 150lbs. 22% Superphosphate ... ... }	9	8	11	0	10	4	118
150lbs. 22% Superphosphate	8	22	8	38	8	30	100
112lbs. Sulphate of Ammonia ... ... } 150lbs. 22% Superphosphate ... ... } 56lbs. Muriate of Potash ... ... }	11	42	10	48	11	15	132

These results indicate that the wheat yield on the light land under test is increased slightly when the application of superphosphate is supplemented by one of sulphate of ammonia and a little more when both sulphate of ammonia and muriate of potash also are applied.

These increases, however, are not sufficient to warrant the application of the special fertilisers as an economic proposition. Lack of humus is probably an important factor affecting the low fertility, and experimental pasture plots have been laid down during 1934 with a view to demonstrating that increased humus is necessary and that by a correct system of pasture management with suitable clovers the light land can be utilised for pastures and an economic crop of wheat grown after a period of pasture and judicious grazing.

CULTIVATION OF ONIONS.

E. T. MORGAN,
Officer-in-Charge, Potato Branch.

For the greater portion of the year Western Australia relies on the Eastern States for her supplies of onions. The quantity imported last year (1934) was 2,128 tons, and the value at the port of shipment was £11,407. It will, therefore, be seen that the local demand is great enough to warrant much more extensive planting of this very necessary vegetable.

The onion is believed to have been one of the earliest plants cultivated by man. It was produced so early in the history of the human race that the time and place of its first use are not known. Its immediate wild ancestor has never been discovered with certainty; but whatever its origin the fact remains that it was cultivated in the dim past over a vast area in Southern Asia, and in the Valley of the Nile. The onion is now grown in every civilised country, and constitutes a very important article of food.

The plant is easy of cultivation, and is one of the most profitable crops that can be grown. Another point in its favour is that, unlike most other crops, it does not exhaust the soil or require that the land be rested at intervals, but yields heavy crops year after year.

Soil.—The ideal soil for onion culture is undoubtedly a good loam, but there is, perhaps, no crop grown which adapts itself to difference of soils and climates as does the onion. It has been, and is, grown profitably in soils ranging from light sand to heavy clay. In fact, some of the best keeping onions are grown in the heavier land, the great drawback being the cultivation of such soils, as at certain periods of the year this class of land gets waterlogged, and in this state it is nearly impossible to get it into suitable condition for the reception of onion plants. Under irrigation, in the light sandy soils of Coogee and Spearwood, crops of up to 20 tons per acre are grown every year, while, relying on the natural rainfall, profitable crops are grown in the South-West from Albany to Geraldton in various classes of soil. In the peaty swamps at Osborne Park heavy crops are obtained, while in the potato-growing areas around Capel, Burekup, Benger and Brunswick small plots have yielded excellently. Messrs. Higgins Bros., the well-known onion growers of Capel, during the 1919 season harvested the phenomenal yield of 43 tons from 1½ acres. Mr. F. Simper, at Beaconsfield, has harvested a crop which yielded 28 tons per acre. This remarkable crop was grown in a very light sandy soil thoroughly enriched with artificial manures and decayed vegetable matter. Yields like these give the onion grower a goal at which to aim, and undoubtedly the area at present planted can be greatly enlarged with profit both to the grower and the State.

Preparation of Seed-Bed.—The method generally adopted in Western Australia is to sow the seed in a well prepared seed-bed, and when the plants are from 4 to 6 inches high, to transplant into the field. The preparation of the seed-bed is one of the main essentials of onion culture. Onion seeds are rather small, and hence require a finely pulverised, moist and well compacted seed bed. The land should be dug as deeply as possible, say from 9 to 12 inches. If the surface soil overlies a heavy clay, it is inadvisable to bring this to the surface, at least in one operation. A rake can be used to bring the soil into a fine tilth, and the back of the rake drawn rather heavily over it or firmed with the back of a spade will bring it into good condition for the sowing of the onion seeds. Artificial manure can be incorporated with the soil during the digging operation. A good

dressing of fertiliser on the top prior to digging, and dug in with a lighter dressing before raking, brings the bed into a satisfactory condition. A suitable manure would be "No. 4" or "E" brand of potato manure, as put up by the local manure works. If obtainable, a dressing of stable manure is desirable, but it must be well rotted, or weeds will be rather troublesome. Make the beds about 6 feet wide, as this width allows hoeing, for the control of weeds, from each side, and does away with the necessity for treading on the bed during weeding operations. Seed should be sown in drills rather than broadcast, as this allows the working of a small hoe in between the plants. A good plan is to make a rake-like structure with picket-shaped "tynes" spaced about 6 inches apart, which, when drawn lightly through the oil, leaves six or eight small channels ready for the sowing of seed. Onion seed is comparatively slow germinating, and it is not advisable to plant deeply; if the land is sufficiently moist, the lighter the covering of soil the better the germination.

Selection of Seed.—It is most essential to obtain fresh, reliable seed true to name. Onion seed loses its vitality very quickly, and none older than last season's crop should be procured. Many experienced growers invariably save their own seed, as by selection and judicious cultivation through a series of years it is possible to raise the standard of excellence. I have often heard it said that we cannot grow onions to compare with those grown in the Eastern States, but I have seen some locally grown that compare very favourably with the imported article. I am convinced that if growers would be more careful in the selection of bulbs planted for seed we should soon have a much higher quality onion. Many growers saving bulbs for planting in order to obtain seed, pick out nice even-shaped and not to large onions. This is quite right, but too little attention is paid to the texture of the skin. Of, perhaps, six onions, similar in size and shape, four may be fairly loose skinned, and the other two may have a large number of very fine, tough skins, closely packed. This, in my opinion, is the type of onion which is desirable to plant for the production of seed. The practice of propagating from the best is sound in all instances of vegetable culture. It is the fine, toughly packed skinned onion which is the best keeper, and I am sure if growers will work along these lines they should have no cause to complain of either the quality or quantity of their crops.

The bulbs saved should be planted out in rows about 3 feet apart. It is advisable to place a stake to each bulb to secure the seed-heads from being blown and knocked about and probably broken by the wind. If the season is favourable —that is warm and dry—a fair amount of well-ripened seed should be obtained.

Promptness in harvesting is essential, for, if delayed too long, the seed receptacles open, and part of the seed will be lost in handling. When the tops have turned yellow, remove them with about 6 inches of stem and place them in strong paper bags, and hang them up in a well-ventilated place to dry. Frequent turning will hasten the drying process, and most of the seed will drop out in the operation. Any seed remaining can be beaten out with a flail or stick; and in the case of a small quantity, rubbing between the hands will satisfactorily extract the seed. It can be cleaned by winnowing. The seed should be stored in a well-ventilated place, free from excessive moisture.

In other cases it may be possible to secure the seed from a neighbouring grower whose stock is known to be good and suited to the district. Where this is not convenient or possible the seed can be obtained from a reliable seedsman. Mixed sorts should be avoided in order that one part of the crop will not ripen before the remainder.

PREPARATION OF LAND.

The preparation of the land for the reception of onion plants is of primary importance, as a good stand, and consequently a good crop will not be obtained from a cloddy paddock. The adage "as fine as an onion bed" is a true one, and in order to obtain a tilth corresponding to this description, such operations as ploughing, harrowing and levelling must be properly carried out. The exact number of times each operation should be performed is not important. One operation is as good as several if a satisfactory tilth is obtained. On the other hand, an indefinite number is not sufficient if the land is still loose, cloddy or uneven.

A sandy loam is usually brought into condition quite easily, but with a clay soil a much more difficult matter has to be faced, and such a soil should be worked as early in the season as possible, before heavy rains set in. It is a good plan to plough the land in the spring and allow it to lie fallow through the summer. At the period of the first rains, say in March, it will be found possible to cultivate the land and bring into good condition sooner than would be possible if left uncultivated until the early part of the growing season.

MANURING.

Onions, like most vegetable crops, need a complete fertiliser and adequate amounts of nitrogen, phosphoric acid and potash are especially important. Properly kept farmyard manures contain these elements, and if the onion-grower has command of a good supply of well-rotted manure, he is in a happy position. If the amount of stable manure is limited, a moderate dressing supplemented by a mixture of artificial fertiliser makes a very good combination. Most of our South-West growers, however, are unable to accumulate stocks of manure—owing to the animals not being stabled—and, therefore, have to rely solely on artificial fertilisers. Many growers follow the system of green manuring, although this is not carried out to the extent it should be. Ploughing in greenstuff is an effective method of improving the humus content of the soil, and as motor transport is rapidly doing away with the horse, this method of supplying humus must be much more resorted to among vegetable growers than is at present. Soil bacteria is much more active in a soil containing a large amount of decomposed vegetable matter, and hence the farmer who wishes to get the best return for his labour will endeavour to supply this very necessary agent.

As the onion is a long-growing plant, the application of a fertiliser containing bone dust, which is fairly slow acting, is good, and a mixture of 4 parts blood and bone, 2 parts of superphosphate, and 1 part of potash, and applied at the rate of 10 cwt. per acre has given satisfactory results. No. 3 or No. 4 Mt. Lyell and Brand "B" or "E" Cuming Smith's potato manures are much used, and are suitable fertilisers. This can be sown broadcast and well worked into the land prior to planting, or sown along the furrow in the same manner as is usually done when planting potatoes. This method is described later, under the heading of transplanting. It is advisable to topdress the plot when the onion bulbs are about one inch in diameter with one of the above mixtures, or a combination of 3 parts superphosphate and 1 part of sulphate of ammonia, applied at the rate of 1-1½ cwts. per acre.

It is not recommended that highly nitrogenous fertilisers be used in the early stages of growth, as these mixtures stimulate top growth and often cause thick stemmed or "bottle-necked" plants, which are not desirable and seldom produce good bulbs.

TRANSPLANTING.

When the plants are from 4-6 inches high, and are nice and sturdy, they are fit for transplanting. They should be dug from the bed, so as to injure the roots as little as possible. As the roots are fairly long, and it is not practicable to make a hole large enough to spread out these roots evenly, it is customary to trim them with a sharp knife to the length of approximately ¾ inch. As there is a balance between root and top to be maintained, it is reasonable to suggest that, as a compensation for this loss, a portion of the top should be cut off, and if an inch or so is removed this will conform to common practice. It is, of course, not suggested that each plant be treated separately, but if a handful of plants are placed on a board the operation can be quickly performed.

The rows should be marked out with the aid of a marker as previously described, but with the "tynes" 1 foot apart. If a line is laid out at one side of the area to be planted, and the outside tyne kept close to it—allowing 4 tynes to the structure—we have 4 rows one foot apart. Again, keeping the outside tyne in the last row marked, we have 3 more rows, and so on. Do not mark too deeply, as onion plants should be planted very shallow. A method often adopted in the South-Western portion of the State is to use the plough. A furrow is struck out, a dressing of fertiliser run along it fairly close to the surface, and another furrow turned over against it. The onion plants are then placed along the intersection of the two furrows, and if the ploughman is expert a straight row is the result. If the plough will turn a furrow of 11 or 12 inches, they may be planted one furrow apart, but if the plough will cut only a narrow width, it is advisable to allow two furrows between the rows. This method allows the planter to walk along the furrow, and so obviates the necessity for trampling the surface of the land during the planting operations, a great advantage if the land is inclined to be wet. If the paddock has been well prepared previous to the transplanting operation, it should plough back very level, and a drag or wheel hoe run along between the rows will leave the plot in good order.

VARIETIES.

The following varieties are recommended:—

Brown Spanish.—The best known variety in cultivation; it is most popular for general use. A good grower and keeper.

Brown Globe.—An onion similar to brown Spanish, but more globular. It shares the latter's popularity for weight-producing.

White Globe.—This is perhaps the finest white onion at present in existence. Bulbs of medium size, mild flavour and juicy.

New Queen.—A silver-skinned onion of quick growth and mild flavour. It is often grown for producing an early crop.

Early Barletta.—The earliest white onion grown. It is not a good keeper, but sown early is very profitable.

CULTIVATION.

Much of the success of the onion crop depends on the amount and efficiency of the cultivation. Cultivation has a twofold purpose; it breaks the crust that has formed because of heavy rains, and also keeps down weeds. Onions cannot compete against weeds, which rob them of nourishment, water and sunlight; hence, the crop must be kept absolutely clean. Wheel hoes are most extensively

used for the cultivation between the rows, but they cannot remove the weeds from between the plants in the rows. This must be done by hand, a tedious process, but an essential one. Small hoes are obtainable 2½-3 inches wide. If the plants are placed about 4 inches apart, this width will allow the effective use of one of these hoes between them. Some growers prefer to allow sufficient width between the rows to allow of horse cultivation. This will tend to decrease the cost of cultivation, but care should be taken not to throw the soil too far and cover the developing bulbs. Onion bulbs develop best when near the surface of the ground, and will not grow as large nor be as good keepers if buried deeply in the soil.

HARVESTING.

Onions take from six to seven months to reach complete development. Bending the stems over is a great aid to ripening; a light roller drawn over them is sometimes used, and it is quite effective. It is not wise to allow the onions to remain in the ground long after the tops have died down as there is always danger of sunburn, and harvesting takes place during the hot weather. When the tops have yellowed and turned down, the bulbs should be lifted and carted to a shady place, preferably an open shed, and spread out thinly, taking care not to bruise the bulbs, or decay will soon set in. An ideal way of harvesting is to place the onions in crates; they can then be stacked one on top of the other, and the air circulating through the slatted sides cures them slowly and effectively. When the tops are dry and shrivelled the onions are fit for market, and no fear need be felt as to their carrying qualities. Growers of very early crops often pull the onions when they have reached a marketable size, and cut off the tops about an inch above the bulb. The onions are quite green, but are fit for immediate use, and when prices are high and where the grower is near the market—as they do not carry well—it no doubt pays him, but for the average onion grower it pays to properly harvest the onion before marketing.

SUMMARY.

1. It is desirable for the grower to have seed grown under his own supervision.
2. Great importance is attached to the selection of bulbs for seed.
3. Correct fertilising is necessary.
4. The land should be kept free from weeds during the growing period.
5. Harvesting practices should be planned so as to avoid sun-burned and immature bulbs.

EGGS.

HOW TO FORWARD THEM TO THE EXPORT FLOORS.

G. D. SHAW,
Poultry Adviser, Department of Agriculture.

Increased local consumption and the export of every possible egg during our period of high production are now recognised as the only means of assisting the poultry industry, and it is the poultry farmer alone who can make possible that assistance.

Throughout all egg producing countries the low consumption of eggs and other poultry products can be traced to no other source than neglect by the farmer in the marketing of his products attractively.

Western Australia is slightly ahead of other Australian States where marketing of eggs is concerned, in that legislation is in force which is tending to educate the farmers in forwarding to market and other places of distribution, eggs which must conform to certain definite standards of quality. Now that the Federal authorities have decided that no export floor can export eggs which have been been cleaned on export floors and that no washed egg can be exported, it is well for the Western Australian farmers that our Agricultural Products Act of 1929 and its regulations governing eggs is in force.

The main clause in our Act which has direct bearing on both local and export marketing is that which defines a clean egg.

It reads:—"No person shall pack any eggs intended for sale which are not clean. For the purpose of this Regulation 'clean eggs' mean eggs which are free from dirt or foreign matter or stains."

Our main aim will be to instruct first and then penalise those producers and others who will not carry out that definite interpretation in the Regulations quoted above. It is by interpreting that regulation in the right spirit that the export of eggs from Western Australia will be made possible during this and other succeeding seasons.

During past years a practice of cleaning eggs on export floors has been allowed to obtain such a hold on the industry that the exploitation of that practice will cause a lowering of the quality of our eggs on arrival in England, and to overcome the possibility of further trouble due to that cleaning on export floors, definite instructions have been issued that the cleaning on export floors must cease —all cleaning must be done at the source of supply, *i.e.*, the farm. As the two departments have now in force regulations which govern the marketing of eggs in clean condition, it will be easy for Western Australian producers to eliminate cleaning on export floors.

This industry cannot be hampered by those careless producers who will not take the trouble to forward clean eggs to market. No sympathy can be offered when one is condemned for marketing dirty eggs. Our intentions are to definitely stabilise an industry which has enormous possibilities, and that industry cannot be hampered by those who keep a few fowls for home use and market the surplus eggs as and when they accumulate, in numbers sufficient to make the marketing worth while.

Eggs must be marketed spotlessly clean and up to grade and quality. To that end all consignors must—

1. Collect eggs twice daily.
2. Clean eggs when collected. Do not wait until the egg has lost its natural heat.
3. Market as often as possible.

1. It is of little use collecting eggs twice daily unless care has been taken to have the nesting material clean. Do not use red sawdust—dry material free from odors is the only preventive of dirty eggs. Do not have nests in the sun or where they can get wet. The approach to a nest should be over dry litter or dry ground.

2. Filth allowed to adhere to an egg for any length of time stains the shell and a stained egg is not a clean egg. Filth will penetrate the shell and set up a deleterious action inside, so clean the egg as soon as it is collected. It saves time and eggs—eggs mean money. Don't use sand-soap and like materials—a damp

rag only is all that is necessary, but if more drastic methods are needed look to the cause and remedy it. Drastic methods of cleaning will not only cause a lowering in quality when the eggs arrive at the markets, but such lowering of quality, since your case has been branded, means a regrading, and regrading will mean at least 2d. per dozen expense to you on all eggs in that consignment.

3. Do not wait a week or a fortnight in order to obtain sufficient to send to market. Send them as soon as transport is available. Quality is desired and any delay in forwarding lowers the quality with disastrous results. Pack in fillers or clean straw. No dirty material is tolerated.

Take a pride in your product. Those who do will be sure to reap the benefit of that extra care applied.

It must be understood that the regulations governing the sale of eggs in Western Australia apply with the same force on both local and export floors, so that very little time should elapse before the regulations on clean eggs issued by the Department of Commerce, Melbourne, should cause no hardship to the industry in Western Australia.

THE FRUIT FLY.

The Need to Continue an Active Campaign Throughout Winter, Spring and Early Summer.

L. J. NEWMAN,

Government Entomologist, Department of Agriculture.

Owing to the continuance of dry and mild weather throughout the autumn, the active reproduction of this pest has continued. This means an added danger of a large carry-over of the fly during the wet season. It is necessary to stress the need for growers to take every means at their disposal for the reduction of the numbers of over-wintering flies.

These flies are attracted to the citrus trees by the odour and there they find suitable shelter in the dense foliage, which protects them against the elements. There is definite evidence that the fruit fly, provided it can obtain the necessary shelter and food, can withstand considerable periods of cold and wet.

It is always important when dealing with an insect pest to know how and where it spends the winter. This knowledge very often reveals some weak link in the life cycle, which makes it possible to attack the pest when it is least able to resist.

This is the case with the fruit fly. All things being equal, the prevalence of fruit fly in the summer is largely governed by the successful carry-over of large numbers of flies during the preceding winter and early spring. Knowing this, every effort should be made to reduce their numbers.

To this end, the following is advised:—

1. Gathering regularly all infested fruits; the destruction of same.
2. Apply foliage bait whenever weather permits.
3. Use covered traps throughout the wet season.

The following are proved lures:—

Beeco—1 part to 40 parts of water.

Clensel—1 part to 30 parts of water.

Foliage bait—Green's Fruitfly Bait. The formula for a home-made preparation is—Juice of 1 dozen oranges, molasses 4 lbs., $2\frac{1}{2}$ oz. powder arsenate of lead, water to make 4 gallons.

A NEW NOXIOUS WEED.

ST. JOHN'S WORT.

(Hypericum perforatum, Linn., var. angustifolium, D.C.)

C. A. Gardner,
Government Botanist.

St. John's Wort is a common European species belonging to the family Hypericaceae, and has the other vernacular names of "St. John's Blood" (in reference to a pigment derived from the glands of the petals), "Witch's Herb," and (in Victoria) "Racecourse weed."

The name Hypericum is of obscure derivation, but is probably either from the Greek *hyperikon,* the name of this species as known to the ancient Greeks, or from *hyper,* under, and *eikon,* an image, in reference to some ancient superstition regarding the plant; the specific name perforatum probably refers to the oil-glands of the leaves which, if held up to the light, appear to be punctured by the small transparent oil-glands. The varietal name, angustifolium (narrow-leaved), refers to the narrow leaves which distinguish the plant from the typical St. John's Wort which normally has broader leaves.

Description of Plant.

A glabrous perennial with erect stems of from one to above three feet in height, arising from a woody creeping root-system, and corymbosely branched upwards, usually forming dense clumps. Leaves sessile, opposite, oblong to linear-oblong or linear, mostly obtuse, variable in size, the upper ones usually under 1cm. long, the stem-leaves often 2cm. long, sprinkled with pellucid oil-dots, and often marked underneath with purplish marks at the margins. Flowers yellow, fairly large, in a much-branched leafy corymbose panicle at the apices of the stems. Calyx divided into 5 acute lobes; petals 5, alternating with the calyx-lobes, irregular, yellow, the margins (especially towards the apices), irregularly toothed or notched, with purple glands in the indentations. Stamens indefinite in number, arranged in three bundles only slightly united at the base; ovary superior, 3-celled, with numerous ovules, styles three, distinct. Fruit a 3-valved capsule containing numerous cylindrical-oblong small brown seeds minutely pitted.

Flowering season November-February.

The plant was formerly much used medicinally, the well-known "St. John's Wort oil" being made from the flowers infused in olive oil, and used as a specific for rheumatism and gout, while a red dye was obtained from the purple glands of the petals and used as an application to wounds under the name of "St. John's blood." A yellow dye was also obtained from the petals.

The species is native to the temperate regions of Europe and Asia, where apparently it is not troublesome, but in other countries to which it has been introduced it has proved a serious weed, as for example the United States of America and Australia. In the ranges of California losses in travelling stock, especially sheep and cattle, are reported. In New South Wales and Victoria it is regarded as one of the most serious of the weeds present in those States, on account of the rapidity of its spread, and the difficulties attending its eradication. The weed is also reported from Tasmania and South Australia, where, so far, it has not had much opportunity of spreading, and the writer has now to officially record the species as occurring in Western Australia, having collected specimens from Margaret River and Karridale in last December. The local plant is the variety angus-

tifolium as found in Eastern Australia, and at the present time the weed is only established in a few small colonies, of which the largest—that at Margaret River—comprises about two acres.

Like many other weeds, St. John's Wort spreads slowly in the initial years of its colonisation. This is the experience both in Victoria and New South Wales, where for many years the weed appeared to be of no consequence, until a stage was reached in its development at which it overran a whole district in a short period. The following table, taken from the Journal of the Council for Scientific and Industrial Research, shows the areas of infestation in Victoria at different periods:—

Year.	Acres.		
	Crown Land.	Private Property.	Total.
1880	...	1	1
1902	2,910	5,639	8,549
1905	4,000	6,210	10,210
1916	156,000	28,000	184,000
1931	...	...	244,519

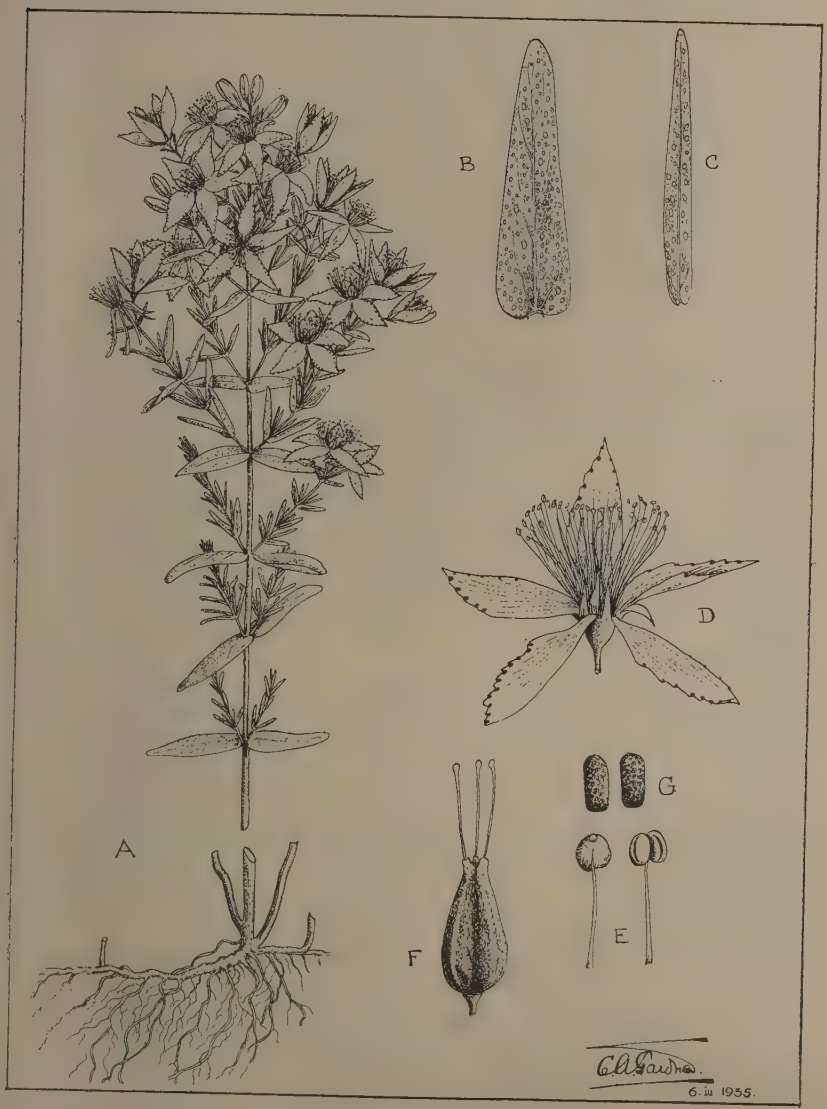
These figures are interesting, and are typical of many serious weeds which, like St. John's Wort, are readily distributed by stock and forage, and are encouraged by cultivation. In the South-West, the only patch of any consequence is one on land which has been cultivated, while the clumps seen near Karridale are confined to small patches in the virgin soil which await the advent of cultivation in order to spread. The New South Wales experience is similar to that of Victoria, and in the former State it is regarded as a serious noxious weed in twenty-two shires and seven municipalities.

The weed is spread principally from cultivated land. Cultivation itself only serves to spread the weed by distributing the roots which develop into leafy shoots when separated from the parent plant. The seeds are carried in forage and in the alimentary tracts of stock and rabbits, and both wind and water are effective agencies in the spread of seed.

The methods of control to be used, therefore, employ the growing of some quick-growing plant which will smother the weed while young, and in this respect success has attended the growing of subterranean clover. The weed should, of course, be cut down prior to the sowing of the clover. Lotus corniculatus and perhaps Lotus major would also prove beneficial in this respect. The use of chemicals is effective, but the commercial sprays are expensive at the present time, although they could be applied with advantage on small areas, such as those at present existing here. A ten per cent. solution of sodium chlorate should prove effective if administered after the plants had been cut off and the young growth not well developed. The chemical would probably have to be applied two or three times, in order to completely destroy the plants. Salt has been found to be effective in Victoria, when applied at the rate of about 6 tons per acre. In Victoria the growing of pine plantations (Pinus radiata) on badly affected land has resulted in the weed being largely diminished through a reduction in the amount of available sunlight. Biological control by insects is a possibility at present being investigated at Canberra.

In addition to being a serious weed, St. John's Wort is also poisonous. When eaten in any quantity it may cause a sensitiveness to light (photosensitization), and the animals which have been fed on the plant, when submitted to strong sunlight for a prolonged period, become inflamed and ulcerated in the unpigmented areas of the skin, and death may result. In addition the ingestion of the plant is stated to produce an effect on the nervous system, causing severe depression or intense mental excitement.

As with other weeds, the effective control depends upon early recognition. Any person, therefore, who suspects the presence of this plant should submit specimens for identification and advice. St. John's Wort is gazetted as a noxious weed for the State of Western Australia.



EXPLANATION OF PLATE.

St. John's Wort.

Hypericum perforatum, Linn. var. angustifolium, D.C.

A, Habit, showing the stem and creeping rootstock; B, stem-leaf; C, upper leaf D, flower; E, stamens; F, ovary and styles; G, seeds.

A, slightly less than natural size; B, C, and D, natural size; E, F, and G, slightly enlarged.

Margaret River, December, 1934. Icon, origin.

FIELD EXPERIMENTS WITH WHEAT AND OATS, 1934.

MERREDIN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

J. Langfield, Farm Manager.

This farm is situated 4 miles west of the Merredin township, which is in the centre of the eastern wheat belt.

The monthly rainfalls as recorded at the farm during 1934, together with average for the period 1912-1933, are as follow:—

Period.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total. for Year
1934	33	13	145	448	26	193	185	147	61	32	644	54	11	1,348
1912-33 ...	51	52	112	79	137	185	187	152	88	85	834	43	54	1,225

The season opened very promisingly, the first rain of any importance falling in March when 145 points were registered. During the first fortnight in April 4½ inches were recorded. This gave the land a thorough soaking and caused a prolific germination of weed seeds. A dry spell was then experienced from mid-April until the end of May. This afforded an excellent opportunity for the destruction of weed growth. The June, July and August rainfall was up to the average, but that of September and October was below.

Although the September and October rainfall was very light, crops finished off better than was expected. This must be attributed to the reserve of moisture in the subsoil from the heavy rain in April.

Owing to the weed growth it was necessary to skim plough the whole of the area to be planted.

This, together with the six weeks dry weather which prevailed from mid-April to the end of May, was responsible for the loss of surface moisture, and which resulted in either uneven germination or retarded germination until the advent of rains early in June.

The land on which the experiments were conducted originally carried salmon gum and gimlet timber. Except when an experiment required otherwise, it was ploughed with a disc implement to a depth of 3 inches during June and July. It was disc cultivated in August and again in October. No further workings were given until April when it was again disc cultivated to cope with vigorous weed growth. All plots were cultivated with a springtyne cultivator before seeding.

The results of the field experiments are tabulated below:—

FALLOW AND NON-FALLOW EXPERIMENT.

To demonstrate the advantage of winter fallowing for the wheat crop.

Planted on 21st May, 1934. Superphosphate—112 lbs. per Acre. Germinated after early June rains
Variety—Totadgin. Seed—45 lbs. per Acre.

Treatment.	Average Yields per Acre. 1934.		Percentage Yields. 1934.	Average Yields per Acre. 1925-34.		Percentage Yields. 1925-34.
	bus.	lbs.	%	bus.	lbs.	%
Fallow	24	48	91	24	40	135
Non-fallow	27	16	100	18	18	100

This is the second occasion since the inception of the experiment that the yields obtained from the unfallowed plots have been higher than those of the fallowed plots, and in each instance heavy rains in March were experienced. By this means a good seed bed was able to be prepared on the unfallowed plot and reserves of moisture from these rains stored in the subsoil. It must be remembered, however, that the advantage of fallowing is most evident when the season is least favourable. From the average results over the past ten years it will be seen that the fallowed plots have exceeded the unfallowed plots by 35 per cent.

TIME FOR PLOUGHING EXPERIMENT.

To determine the effect of early, midwinter, and late winter fallowing on the resultant wheat crop.

Planted on 21st May, 1934. Superphosphate—112 lbs. per Acre. Germinated after early June rains.
Variety—Totadgin. Seed—45 lbs. per Acre.

Ploughed.	Average Yields per Acre, 1934.		Percentage Yields, 1934.	Average Yields per Acre, 1930–34		Percentage Yields, 1930–34.
	bus.	lbs.	%	bus.	lbs.	%
Mid-June, 1933	27	20	100	17	41	100
Mid-July, 1933	28	4	103	16	23	93
Mid-August, 1933	24	8	88	13	13	75

The average results demonstrate the advantage of early winter fallowing and that the later the initial ploughing is carried out so the yields are correspondingly reduced.

MULCHING EXPERIMENT.

To determine to what extent the cultivation of winter fallowed land is profitable during the spring and summer months.

Planted on 10th May, 1934. Superphosphate—112lbs. per Acre. Germinated after early June rains.
Variety—Totadgin. Seed—45lbs. per Acre.

Treatment.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Average Yields per acre, 1915-34.	Per-centage Yields, 1915-34
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Mulched in spring after rain, during summer, and before seeding	30 24	30 24	29 12	30 56	29 4	30 0	115	22 15	102
Mulched in spring and before planting only	25 44	29 36	26 0	23 44	25 28	26 6	100	21 50	100
Mulched before planting only	28 32	26 24	29 52	23 36	22 32	26 11	100	20 41	95

The average results for the duration of the experiment indicate that the general practice should be to cultivate the fallow during spring and again prior to seeding, and where the ground is weedy this cultivation should be supplemented by additional cultivations after rains during the summer months.

RATE OF SEEDING EXPERIMENT.

To determine the most economical rate of planting a mid-season free-stooling variety.

Planted on 10th May, 1934. Superphosphate—112lbs. per Acre. Germinated after early June rains.
Variety—Nabawa.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Average Yields per acre, 1913-34. *	Per-centage Yields, 1913-34. *
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30lbs.	27 20	26 16	26 56	25 4	28 56	26 54	91	19 53	95
45lbs.	28 32	30 40	28 40	27 44	32 16	29 34	100	20 58	100
60lbs.	29 4	30 8	28 48	29 12	33 20	30 6	102	21 4	100

* Excluding 1914.

To determine the most economical rate of planting an early sparse-stooling variety.

Planted on 24th May, 1934. Superphosphate—112lbs. per Acre. Germinated after early June rains.
Variety—Noongaar.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1913-34. *	Percentage Yields, 1913-34. *
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
30lbs.	23 20	22 48	22 40	23 12	22 24	22 53	91	19 8	96
45lbs.	24 56	25 12	24 8	25 52	25 4	25 2	100	19 58	100
60lbs.	25 44	25 4	25 52	26 0	25 52	25 42	103	19 45	99

* Excluding 1914.

The results for this year and the average results for the duration of the experiment show that there is no advantage to be gained by seeding either sparse or free-stooling varieties at more than 45 lbs. per acre.

TIME OF PLANTING EXPERIMENT.

To determine the most suitable month to plant a midseason maturing variety.

April plots germinated immediately ; May plots germinated after early June rains ; June plots germinated immediately.

Variety—Nabawa. Superphosphate—112lbs. per Acre. Seed—45lbs. per Acre.

When Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1929-34.	Percentage Yields, 1929-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
April 15th	30 8	31 36	30 0	25 4	28 56	29 9	140	25 13	107
May 15th	21 20	21 44	21 52	20 16	18 56	20 50	100	23 28	100
June 15th	19 44	17 28	18 16	18 48	18 48	18 37	89	19 32	83

To determine the most suitable month to plant an early maturing variety.

May plots germinated after early June rains ; June-July plots germinated immediately.

Variety—Gluyas Early. Superphosphate—112lbs. per Acre. Seed—45lbs. per Acre.

When Planted.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1923-34.	Percentage Yields, 1923-34.
	bus lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
15th June	21 44	22 16	22 24	24 56	22 16	22 43	87	22 19	90
15th May	26 0	25 20	25 52	26 40	26 32	26 5	100	24 47	100
15th July	13 12	14 0	12 24	12 24	12 40	12 56	50	14 10	57

Owing to the very dry period throughout May, the plots sown during that month did not germinate until early in June, and only about a fortnight earlier than the plots sown in this latter month. As the April sown plots germinated immediately they had a much better start than those planted in May and June and yielded considerably higher than them. The average results show a slight advantage for the April sown plots and that it is inadvisable to extend the planting of a midseason variety into June.

Although the May sown plots, with an early variety, did not germinate until early in June the results for this year and the average results for twelve years show here also, that it is inadvisable to extend the planting season into June.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

To determine the most profitable amount of superphosphate to apply to the wheat crops.

Planted on 11th May, 1934. Seed—45lbs. per Acre. Germinated after early June rains.
Variety—Totadgin.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1929-34.	Percentage Yields, 1929-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
75lbs.	23 12	22 48	21 44	21 28	20 16	21 54	88	23 29	91
150lbs.	25 12	24 16	24 16	25 36	25 28	24 58	100	25 48	100
Nil	14 16	14 8	12 24	13 52	11 36	13 15	53	14 58	58

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1929-34.	Percentage Yields, 1929-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
300lbs.	26 32	26 40	24 16	25 12	23 52	25 18	108	27 42	106
150lbs.	22 32	24 0	24 16	22 48	23 20	23 23	100	26 10	100
225lbs.	24 48	23 44	26 40	25 20	24 32	25 1	107	27 15	104

This year's results and the averages over six years indicate that the rate of superphosphate could be increased with advantage above 75 lbs. per acre.

Although the applications of higher rates give increased yields, the most economical rate under present economic conditions on this class of soil would probably be about 112 lbs. per acre.

POTASH-NITROGEN EXPERIMENT.

To determine the effect upon the wheat crop of (a) a nitrogenous fertiliser; (b) a nitrogenous plus a potassic fertiliser.

Planted on 14th May, 1934. Germinated after early June rains. Superphosphate—112lbs. per acre.
Variety—Bencubbin. Seed—45lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1932-34.	Percentage Yields, 1932-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
112lbs. Sulphate of Ammonia ... 112lbs. Superphosphate ...	31 28	28 16	31 20	32 24	36 0	31 54	104	28 7	102
112lbs. Superphosphate ...	28 56	29 28	28 40	32 8	33 44	30 35	100	27 30	100
112lbs. Sulphate of Ammonia ... 56lbs. Sulphate Potash ... 112lbs. Susperphosphate ...	28 48	33 28	30 48	35 44	27 28	31 15	102	27 35	100

The average results show that the increased yield obtained when an application of superphosphate is supplemented with either a nitrogenous fertiliser or a nitrogenous and a potassic fertiliser is insufficient to cover the cost of these special fertilisers.

SEASONAL PLANTING EXPERIMENT.

(a) To ascertain the most suitable month to plant a midseason, early, and very early maturing variety of wheat.

(b) To determine the most prolific of those crops.

Planted on 15th April, 1934. Germinated immediately. Superphosphate 112 lbs. per acre.
Seed—45 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Percentage Yields, 1929–34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Bencubbin	32 16	31 20	34 16	36 32	33 44	33 38	110	114
Nabawa	29 52	29 44	30 32	30 48	32 0	30 35	100	100
M 38	32 24	33 20	31 44	29 4	29 28	31 12	102	*

* One year's trial only.

Planted on 15th May, 1934. Germinated after early June rains. Superphosphate—112lbs. per acre.
Seed—45 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1934.	Percentage Yields, 1934.	Percentage Yields, 1928–34.
	bus. lb.	bus.lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Bencubbin	27 12	28 24	26 24	25 52	33 4	28 11	110	113 (1929–34)
Nabawa	24 16	26 40	24 16	26 24	26 16	25 34	100	100
M 38	22 8	27 52	23 28	27 12	26 32	25 26	99	...
Gluyas Early ...	24 24	26 24	28 48	27 52	29 52	27 28	114	108
Nabawa	22 0	23 4	24 16	25 4	25 36	24 0	100	100
Totadgin	24 24	28 32	25 36	28 0	29 4	27 7	113	117 (1931–34)
Geeralying	18 16	23 12	21 52	24 48	24 48	22 35	97	96
Nabawa	20 32	22 32	23 12	25 44	24 56	23 23	100	100
Merredin	25 4	26 8	25 28	27 44	23 28	25 34	109	108
M 26	20 0	20 24	22 40	22 48	21 20	21 26	91	79 (1932–34)
Nabawa	21 12	21 4	26 16	25 44	24 0	23 39	100	100
Carrabin	19 12	21 44	26 32	24 8	28 0	23 55	101	93
S.H.J.	17 4	21 12	22 0	20 24	20 56	20 19	83	88
Nabawa	20 40	25 20	22 32	26 8	27 20	24 24	100	100
Noongaar	24 56	27 36	26 16	28 40	27 28	26 59	111	100

Planted on 15th and 21st June, 1934. Germinated immediately. Superphosphate—112lbs. per acre.
Seed—45lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1934.	Percentage Yields, 1934.	Percentage Yields, 1928–34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar	19 4	18 8	16 32	20 8	25 4	19 47	108	114
Nabawa	17 4	17 28	18 24	17 36	20 48	18 16	100	100
S.H.J.	13 44	13 4	15 44	14 16	17 44	14 54	82	89
Carrabin	14 8	13 12	17 28	17 44	19 44	16 27	93	96
Nabawa	16 32	16 56	17 36	19 12	18 32	17 46	100	100
M 26	13 44	14 0	15 44	18 8	16 32	15 38	88	95*
Merredin	14 32	20 0	20 40	20 48	18 48	18 58	98	108
Nabawa	15 36	21 20	20 16	19 12	20 16	19 20	100	100
Geeralying	16 48	16 24	18 0	20 16	19 52	18 16	94	98
Totadgin	19 20	20 48	21 4	22 56	22 0	21 14	108	117†
Nabawa	17 12	20 8	20 8	20 48	20 16	19 42	100	100
Gluyas Early ...	20 0	19 44	20 16	25 4	21 20	21 17	108	110
M 38	19 36	18 56	19 20	22 32	19 4	19 54	98	‡
Nabawa	19 52	19 52	21 4	20 56	19 44	20 18	100	100
Bencubbin	22 8	20 8	22 32	23 52	20 40	21 52	108	113

* 1932–34. † 1931–34. ‡ 1934 only.

The results show Bencubbin as the most prolific midseason maturing variety. Of the early maturing types, Gluyas Early and Totadgin are equal in this season's results, but Totadgin shows to advantage in the average results. Of the very early maturing varieties Noongaar is outstanding.

Satisfactory yields were obtained this year from Bencubbin in all sections and also from the other mentioned varieties in the May and June plantings, with the yields from the May planting showing to considerable advantage. This confirms the results of the Time of Planting Experiment in that decreased yields can be expected when the planting is extended into June.

OAT VARIETY TRIAL.

FOR HAY.

Planted on 24th May, 1934. Superphosphate—112lbs. per Acre. Seed—40lbs. per Acre. Germinated after early June rains.

Variety.	Computed Yields per Acre. Section 1.			Section 2.			Average Yields per Acre, 1934.			Percentage Yields, 1934.	Average Yields per Acre, 1930–34.			Percentage Yields, 1930–34.
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	%	cwt.	qrs.	lbs.	%
Mulga	46	0	0	43	1	4	44	2	16	100	50	1	13	100
Guyra	44	3	4	44	3	20	44	3	12	100	46	3	7	93
Gidgee ...	50	2	16	52	1	12	51	2	0	120	54	2	8	107
Mulga	41	0	16	44	1	20	42	3	4	100	50	3	26	100
Mulga	44	0	24	40	1	4	42	1	0	100	...			...
C92	38		24	42	0	0	40	1	12	96	..			...
Laggan	46	2	24	46	1	12	46	2	4	114	...			...
Mulga	41	2	0	39	3	12	40	2	20	100	...			...

FOR GRAIN.

Planted on 24th May, 1934. Germinated after early June rains. Seed—40lbs. per acre. Superphosphate—112lbs. per acre

Variety.	Computed Yields per Acre. Sec. 1.		Sec. 2.		Sec. 3.		Average Yields per acre, 1934.		Percentage Yields, 1934.	Average Yields per acre, 1930–34.		Percentage Yields, 1930–34.
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
Mulga	43	0	39	16	40	16	40	37	100	37	34	100
Guyra	41	32	37	16	37	32	39	0	95	36	29	97
Gidgee	38	32	35	32	36	24	37	2	89	36	18	98
Mulga	43	8	38	24	42	24	41	18	100	37	25	100
Mulga	38	0	37	16	40	0	38	18	100	...		...
C 92	38	8	38	32	40	32	39	10	102	...		...
Laggan	38	8	36	8	38	32	37	30	90	...		...
Mulga	40	32	42	16	43	8	42	6	100	...		...

For this year, and the average for 5 years, the early maturing variety Gidgee has proved to be the best variety for hay, while for grain the standard early maturing variety Mulga is superior. The crossbred variety C92, however, yielded very well for grain the first year of its trial in this experiment.

The early maturing varieties Gidgee and Laggan are shown to advantage in those plots harvested for hay. In those harvested for grain, however, this advantage is not maintained.

WONGAN HILLS LIGHT LANDS FARM.

I. THOMAS, Superintendent of Wheat Farms.

A. R. VENTON, Farm Manager.

The monthly rainfalls for the year, as recorded at the farm, together with the average for the period 1926-33, are as follow:—

Period.	Jan.	Feb.	Mar.	Apl.	Growing Period— May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1934	79	15	187	320	102	184	291	206	98	45	926	37	16	1,580
1926-33 ...	24	34	87	66	178	264	290	203	85	102	1,122	29	41	1,403

The season opened promisingly with early rains in March and April which germinated weeds, but the following weather was so conducive to plant growth that weed control was rendered very difficult. With the prevalence of weeds, planting was delayed.

The rainfalls for May and June were below the monthly average in each case; July and August showed an improvement, but September and October failed to record average figures, but this comparatively dry period did not adversely affect the maturing of the crops.

The experiments were conducted on the typical smokebush and tussocky type of sandplain.

The land on which the experiments were conducted was ploughed with a disc cultivating plough in July, 1933, and cultivated with a springtyne implement in late September and early October. It was grazed with sheep during the winter and up to the end of October. It was again springtyne cultivated after early rains in April and again in May. This was followed by a cultivation with a disc implement to kill weeds, after which it was harrowed prior to planting.

The results of the field experiments conducted during 1933 are tabulated below:—

RATE OF SEEDING EXPERIMENT—WHEAT.

To determine the most Economical Rate of Planting a Mid-season Free-stooling Variety.

Planted on June 5th, 1934. Variety—Nabawa. Germinated on 16th June. Superphosphate—130 lbs. per acre.

Seed.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre. 1925-34.	Percentage Yields. 1925-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
60 lbs. per acre ...	16 40	10 56	13 36	14 8	19 28	14 58	101	16 18	103
45 lbs. per acre ...	14 0	11 28	13 28	16 48	18 0	14 45	100	15 50	100
90 lbs. per acre ...	13 36	12 48	15 4	17 20	18 8	15 23	104	16 19	103

To determine the most Economical Rate of Planting an Early Sparse-stooling Variety.

Planted on June 5th, 1934. Variety—S.H.J. Germinated on 16th June. Superphosphate—130 lbs. per acre.

Seed.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1925-34.	Percentage Yields. 1925-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
60 lbs. per acre ...	15 28	13 36	12 24	12 32	14 16	13 39	105	13 32	103
45 lbs. per acre ...	14 24	12 0	12 40	11 44	14 8	12 59	100	13 8	100
90 lbs. per acre ...	14 0	13 20	13 28	*	13 12	13 30	104	13 52	106

* Lost owing to accident during harvesting.

The average results over a period of ten years indicate there is no advantage to be gained by increasing the rate of seeding above 45 lbs. per acre.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

To determine the most Profitable Amount of Superphosphate to apply to the Wheat Crop.

Planted on 21st May, 1934. Variety—Nabawa. Seed—45 lbs. per acre.

Germinated on 1st June.

Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1929–34.	Percentage Yields, 1929–34.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
75 lbs.	21 12	19 52	20 56	24 56	25 12	22 26	84	14 1	81
150 lbs.	22 32	22 32	27 52	26 56	25 28	25 4	100	17 22	100
Nil	8 40	9 20	9 28	9 52	9 12	9 18	37	3 39	21

Planted on 22nd May, 1934. Variety—Nabawa. Seed—45 lbs. per acre.

Germinated on 1st June.

Superphosphate.	Computed Yields per Acre.					Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre. 1929 34.	Percentage Yields, 1929–34.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
300 lbs.	17 44	18 48	19 36	24 48	19 52	20 10	88	17 51	103
150 lbs. ...	19 44	22 8	23 52	23 44	24 32	22 48	100	17 23	100
225 lbs.	19 28	22 8	21 36	26 8	17 12	21 18	93	17 50	103

This year's results confirm those of previous years, viz., that it is advantageous to apply considerably more than 75 lbs. of superphosphate on this class of land. Even at present low prices for wheat an application of at least 120 lbs. per acre is warranted.

It will be noticed that the average yield from the plots receiving no superphosphate for last season is considerably greater than the average for the six years for which the experiment has been conducted.

In only two years have returns been obtained from the "no super" plots, and these were due solely to the residual effect of superphosphate which had been applied to the soil in previous years. In these two years there was no land available for cropping to which superphosphate had not previously been applied.

POTASH NITROGEN EXPERIMENT.

To determine the effect upon the Wheat Crop of: (a) a Nitrogenous Fertiliser; (b) a Nitrogenous + a Potassic Fertiliser.

Planted on 22nd May, 1934. Variety—Nabawa. Seed—45 lbs. per acre.

Germinated on 1st June.

Rate of Application of Fertiliser per acre.	Computed Yields per Acre.					Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre. 1932–34.	Percentage Yields, 1932–34.
	Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.				
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.		bus. lb.	
112 lbs. Sulphate of Ammonia 112 lbs. Super. ...	22 24	23 4	21 20	20 56	22 0	21 57	121	20 3	119
112 lbs. Super. ...	20 40	19 12	17 44	16 56	16 8	18 8	100	16 51	100
112 lbs. Sulphate of Ammonia 112 lbs. Super. ... 56 lbs. Muriate of Potash	24 32	20 48	20 24	21 52	22 0	21 55	121	20 43	123

This year's results show that a considerably increased yield can be expected when a heavy dressing of a nitrogenous fertiliser is applied, but that no further increase is obtained by the addition of a potassic fertiliser. The average results for the three years are similar, except that a slight increase in yield is indicated by the use of a potassic fertiliser.

The gains in yield, however, do not warrant the additional cost of these special fertilisers.

SEASONAL PLANTING EXPERIMENT.

(a) To determine the most Suitable Month to Plant the Late, Mid-season, and Early Varieties of Wheat.
(b) To determine the most Prolific of these Types.

APRIL.

Planted on 17th April, 1934. Germinated on 26th April. Seed—45 lbs. per acre. Superphosphate—135 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1934.	Percentage Yields, 1934.	Percentage Yields, 1928–34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Yandilla King ...	5 12	4 56	5 44	4 56	6 24	5 26	91	102
Nabawa	6 32	5 4	5 4	6 24	6 48	5 58	100	100
Sutton	4 16	4 40	4 32	3 52	4 40	4 24	74	106*
Bencubbin	6 24	7 20	6 16	5 52	7 12	6 37	92	117†
Nabawa	6 40	7 44	6 40	6 56	8 8	7 14	100	100
Gluyas Early ...	5 4	5 4	4 40	6 8	6 16	5 26	75	92
Totadgin	5 12	5 20	6 0	4 48	6 24	5 33	105	92‡
Nabawa	4 48	4 48	4 48	4 24	7 36	5 17	100	100

* 1931–34. † 1930–34. ‡ 1932–34.

MAY.

Planted on 16th May, 1934. Germinated on 26th May. Seed—45 lbs. per acre. Superphosphate—135 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre. 1934.	Percentage Yields, 1934.	Percentage Yields, 1928–34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Geeralying	14 32	15 20	18 24	16 16	16 40	16 14	93	86*
Nabawa	14 48	15 36	19 20	17 36	19 36	17 23	100	100
Noongaar	13 12	13 4	14 8	14 40	14 0	13 41	79	67
Gluyas Early ...	14 8	14 16	18 16	19 20	18 24	16 53	94	94*
Nabawa	15 4	15 28	20 0	18 40	21 4	18 3	100	100
Totadgin	14 32	15 36	19 12	16 56	18 16	16 54	94	87†
S.H.J.	11 12	13 20	17 28	18 40	17 36	15 39	95	90
Nabawa	12 40	13 28	20 8	18 40	17 44	16 32	100	100
Merredin	13 12	14 56	19 36	18 16	18 16	16 51	102	89*
Bencubbin	11 20	15 4	18 0	18 40	18 0	16 13	103	110‡
Nabawa	11 36	12 48	18 8	17 52	18 40	15 49	100	100
Carrabin	13 52	14 48	18 48	19 36	20 40	17 33	111	97
Yandilla King ...	11 4	12 8	15 28	19 20	17 44	15 9	94	90
Nabawa	12 8	13 52	17 28	19 12	17 52	16 6	100	100
Sutton	8 56	13 28	16 40	18 16	18 32	15 10	94	92§

* 1929–34. † 1932–34. ‡ 1930–34. §1931–34.

JUNE.

Planted on 15th June, 1934. Germinated on 26th June. Superphosphate—135 lbs. per acre.
Seed—45 lbs. per acre.

Variety.	Computed Yields per Acre.										Average Yields per acre. 1934.		Per-centage Yields, 1934.	Per-centage Yields, 1928-34.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.					
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	%
Geeralying	16	40	18	40	19	4	20	8	18	40	18	38	98	86†
Nabawa	16	56	19	20	19	52	20	32	18	48	19	6	100	100
Bencubbin	18	24	17	44	20	0	20	56	17	52	18	59	99	108*
Carrabin	21	44	25	36	25	12	25	36	22	56	24	13	119	94
Nabawa	18	40	20	0	21	28	22	24	18	56	18	18	100	100
S.H.J.	20	8	22	56	22	56	21	44	19	52	21	31	106	89
Gluyas Early ...	19	44	20	16	20	24	19	4	17	12	19	20	93	89
Nabawa	20	16	20	16	23	12	20	56	18	56	20	43	100	100
Totadgin	15	28	15	52	20	40	17	52	17	4	17	23	84	81‡
Merredin	20	32	19	4	21	4	21	4	19	52	20	19	98	92†
Nabawa	19	36	21	20	21	52	21	12	19	20	20	40	100	100
Noongaar	20	0	21	36	21	36	20	32	19	52	20	43	100	86

* 1930–34. † 1929–34. ‡ 1932–34.

The yields from the varieties sown in April last year were very low, due in the main to considerable weed growth. This weed growth was more successfully coped with prior to the seeding of the May and particularly the June plots, and hence the comparatively good yields from these sections. The average results show that late and midseason varieties are best suited for early planting in April, while midseason varieties also show to advantage for both May and June planting.

It will be noticed that the early maturing varieties last year showed to advantage in all sections which is at variance with the average results, and is due, no doubt, to their more rapid early growth, when the weed trouble is controlled.

The yields from the June section last year would seem to indicate that planting in that month should be quite successful. These results are, however, at variance with the yields over a number of years, and due to dry conditions in May retarding germination, and also the less complete control of weeds in crops planted during that period.

RATE OF SEEDING EXPERIMENT—OATS.

The average results obtained with both varieties over a number of years indicate that with both sparse and free stooling varieties it is not economical to seed at a greater rate than 45 lbs. per acre.

To determine the most Economical Rate of Planting a Late Free-stooling Variety.

Planted on 5th June, 1934. Variety—Algerian. Superphosphate—130 lbs. per acre.
Germinated on 16th June.

Seed.	Computed Yields per Acre.										Average Yields per acre, 1934.		Per-centage Yields, 1934.	Average Yields per acre, 1926–34.		Per-centage Yields, 1926–34.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
45 lbs. per acre ...	22	24	20	0	18	0	20	24	17	0	19	26	107	15	39	107
30 lbs. per acre....	22	8	18	8	17	32	19	0	14	32	18	16	100	15	0	100
60 lbs. per acre ...	21	24	19	16	20	8	22	8	16	8	19	37	108	16	17	109

To determine the most Economical Rate of Planting an Early Sparse-stooling Variety.

Planted on 5th June, 1934. Variety—Burt's Early. Superphosphate—130 lbs. per acre.
Germinated on 16th June.

Seed.	Computed Yields per Acre.										Average Yields per acre, 1926.		Per-centage Yields, 1926.	Average Yields per acre. 1926–34.		Per-centage Yields, 1926–34.
	Sec. 1.		Sec. 2.		Sec. 3.		Sec. 4.		Sec. 5.							
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	%	bus.	lb.	%
45 lbs. per acre ...	13	24	15	16	14	24	17	32	16	16	15	22	101	15	29	102
30 lbs. per acre ...	13	24	15	0	15	8	17	16	16	8	15	19	100	15	19	100
60 lbs. per acre ...	14	16	15	0	16	24	17	0	16	24	15	37	103	15	38	103

YILGARN EXPERIMENT FARM.

I. THOMAS, Superintendent of Wheat Farms.

R. W. Prunster, Farm Manager.

This farm is situated 8 miles east of Southern Cross on the fringe of our main eastern wheat belt.

The total rainfall for 1934 was 1,360 points, which is 289 points above the average. The rainfall during the growing period was 633 points, or 83 points below the average.

The following table shows the monthly rainfalls, together with the averages for the period records have been kept at the farm (6 years).

Period.	Jan.	Feb.	Mar.	Apl.	Growing Period. May.	June.	July.	Aug.	Sept.	Oct.	Total.	Nov.	Dec.	Total for Year.
1934	123	*Nil*	122	453	*Nil*	167	147	197	77	45	633	23	6	1,360
Average (6 yrs), 1928–33 ...	35	57	58	77	202	153	110	146	46	59	716	71	57	1,071

Heavy rains were experienced during March and April. These were followed by a prolonged dry spell during the month of May. With the earlier rains weed seeds germinated freely, the young plants being dealt with by subsequent cultivation. The plots planted in April germinated evenly but those planted early in May germinated unevenly and those planted later in the month did not germinate until the advent of rain in early June. Conditions during June, July and August were satisfactory, but comparatively light though beneficial rains were experienced during September. These rains were apparently assisted by reserves of moisture in the subsoil due to the heavy autumn rains, and, consequently, the crops withstood the drier conditions reasonably well.

The land on which the experiments were conducted originally carried salmon gum and odd gimlet and was previously cropped in 1930. Unless the experiment required otherwise, it was disc ploughed in July, 1933, and cultivated with a springtyne implement in September and again in March and April after rain.

A further springtyne cultivation was given immediately prior to planting.

The results of the field experiments conducted during 1934 are shown below.

MULCHING EXPERIMENT.

To determine to what extent the cultivation of winter fallowed land is profitable during the spring and summer months.

Planted on 18th May, 1934. Superphosphate—100lbs. per acre. Germinated after early June rains.
Variety—Gluyas Early. Seed—35lbs. per acre.

Treatment.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1933-34.	Percentage Yields, 1933-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
Cultivated before seeding only	12 8	14 16	15 12	15 12	15 12	14 24	109	15 39	105
In spring and before seeding ...	12 24	11 44	14 24	14 0	13 44	13 12	100	14 59	100
In spring, during summer after rain, and before seeding	12 8	10 24	12 48	12 56	13 20	12 16	93	14 18	95

This year's results indicate that where the land is not disturbed after ploughing until seeding time, the maximum yields will result, but for the average of two years for which this experiment has only been conducted, no significant difference is apparent. The results of similar experiments elsewhere show that the general practice should be to cultivate the fallow during spring and again prior to seed-

ing, and where the ground is weedy this cultivation should be supplemented by additional cultivations after rain during the summer months.

TIME OF SEEDING EXPERIMENT.

To determine the most suitable month to plant a midseason maturing variety.

April plots germinated irregularly ; May plots germinated after early June rains ; June plots germinated immediately after planting.

Variety—Nabawa. Superphosphate—100lbs. per acre. Seed—35lbs. per acre.

Planted.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1928-34.	Percentage Yields, 1928-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
April 16th	17 36	19 20	23 20	22 8	22 0	20 53	121	19 29	103
May 18th	15 52	17 20	20 16	17 20	15 36	17 17	100	18 50	100
June 21st	12 16	14 48	15 28	13 20	14 40	14 6	82	10 55	58

To determine the most suitable month to plant an early maturing variety.

May plots germinated after early June rains ; June plots germinated immediately after planting ; July plots germinated immediately after planting.

Variety—Gluyas Early. Superphosphate—100lbs. per acre. Seed—35lbs. per acre.

Planted.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1928-34.	Percentage Yields, 1928-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
May 18th	21 36	21 36	19 36	22 24	23 12	21 41	100	19 6	100
June 20th	17 12	18 24	15 36	18 40	19 4	17 47	82	13 13	69
July 18th	8 0	8 0	8 8	7 28	11 4	8 32	39	6 53	36

From these results the best returns can be expected from a midseason variety when it is planted in April, and from an early maturing variety considerably reduced yields can be expected if the planting is extended into the month of June.

RATE OF SEEDING EXPERIMENT.

To determine the most economical rate of planting a midseason free-stooling variety.

Planted on 18th April, 1934. Germinated immediately. Superphosphate—100lbs. per acre.

Variety—Nabawa.

Rate of Seed per Acre.	Computed Yields per acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1931-34.	Percentage Yields, 1931-34
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
20lbs.	16 56	18 24	17 44	18 40	18 8	17 58	85	15 47	85
40lbs.	21 12	22 16	21 20	20 40	19 44	21 2	100	18 31	100
30lbs.	20 48	21 28	20 8	20 40	19 20	20 29	97	c7 58	97

To determine the most economical rate of planting an early sparse-stooling variety.

Planted on 5th June, 1934. Germinated immediately. Superphosphate—100lbs. per Acre.

Variety Noongaar.

Rate of Seed per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Average Yields per acre, 1931-34.	Percentage Yields, 1931-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bys. lb.	%	bus. lb.	%
20lbs.	19 12	18 0	17 20	17 4	17 4	17 44	95	15 10	88
40lbs.	21 28	18 40	16 32	18 8	18 56	18 45	100	17 11	100
30lbs.	18 40	17 12	16 0	16 48	18 32	17 26	93	16 20	95

Both this year's results and the average results with both the free and the sparse-stooling varieties indicate that the rate of 20 lbs. per acre is insufficient and that the rate of 40 lbs. per acre shows to slight advantage against the rate of 30 lbs. per acre.

RATE OF APPLICATION OF SUPERPHOSPHATE EXPERIMENT.

To determine the most profitable amount of superphosphate to apply to the wheat crop.

No. 1.

Planted on 21st May, 1934. Germinated after early June rains. Seed—35lbs. per Acre.
Variety—Gluyas Early.

Rate of Application of Superphosphate per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Average Yields per acre, 1929-34.	Per-centage Yields, 1929-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
225 lbs.	17 36	18 8	17 12	*	17 28	17 36	101	17 18	100
150 lbs.	17 12	18 0	17 36	17 44	16 24	17 23	100	17 13	100
300 lbs.	17 52	19 20	19 12	17 28	17 28	18 16	105	17 33	102

* Discarded owing to mechanical defect.

No. 2.

Planted on 20th May, 1934. Germinated after early June rains. Seed—35lbs. per acre.
Variety—Gluyas Early.

Rate of Application of Superphosphate per acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Average Yields per acre, 1929-34.	Per-centage Yields, 1929-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
75 lbs.	17 44	15 52	16 48	17 4	16 16	16 45	84	16 17	86
150 lbs.	19 52	20 48	20 24	20 8	18 56	20 2	100	18 54	100
Nil	8 16	8 32	8 24	8 16	8 32	8 24	42	11 18	60

These results again show that increased yields are obtained when superphosphate is applied up to 150 lbs. per acre. Under present economic conditions, the most economical rate of application appears to be between 100 and 112 lbs. per acre.

POTASH-NITROGEN EXPERIMENT.

To determine the effect upon the wheat crop of (a) a nitrogenous fertiliser; (b) a nitrogenous + a potassic fertiliser.

Planted on 20th May, 1934. Germinated after early June rains. Superphosphate—100lbs. per acre.
Variety—Gluyas Early. Seed—35lbs. per acre.

Rate of Application of Fertiliser per Acre.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Average Yields per acre, 1933-34.	Per-centage Yields, 1933-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	bus. lb.	%
112 lbs. Sulphate of Ammonia; 112 lbs. Superphosphate ...	20 56	19 4	18 32	18 0	19 4	19 7	98	19 10	98
112 lbs. Superphosphate ...	20 48	19 4	18 24	19 4	19 44	19 25	100	19 34	100
112 lbs. Sulphate of Ammonia 112 lbs. Superphosphate ... 56 lbs Muriate of Potash ...	20 8	18 56	17 28	18 48	20 24	19 9	98	19 9	98

The results indicate that increased yields cannot be expected by the application of either a nitrogenous or a potassic fertiliser.

SEASONAL PLANTING EXPERIMENT.

To ascertain the most suitable month to plant the midseason early and very early maturing varieties of wheat.

To determine the most prolific of these crops.

April Planting.

Planted on 18th April, 1934. Germinated immediately. Superphosphate—100 lbs. per acre.
Seed—35lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Per-centage Yields, 1934.	Per-centage Yields, 1932-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar	11 28	11 4	12 32	13 12	11 52	12 2	67	68
Gluyas Early	16 8	17 52	17 4	18 40	20 24	18 2	100	100
Totadgin	16 56	17 36	17 12	18 48	19 12	17 57	100	104
Bencubbin	17 28	20 16	20 40	22 40	21 44	20 34	118	111
Gluyas Early	16 8	17 36	17 20	18 56	16 56	17 23	100	100
Nabawa	17 28	19 44	18 32	20 48	20 32	19 25	112	105

May Planting.

Planted on 16th May, 1934. Germinated after early June rains. Superphosphate—100lbs. per acre.
Seed—35 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Percentage Yields, 1932-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar	21 4	20 8	20 0	17 52	17 44	19 22	100	80
Gluyas Early	20 24	19 12	20 24	19 12	18 0	19 26	100	100
Geeralying	18 0	17 20	17 44	16 24	16 24	17 10	88	86
Merredin	22 0	22 24	21 12	20 8	19 36	21 4	106	99
Gluyas Early	21 4	20 40	20 16	19 4	17 52	19 47	100	100
Totadgin	21 4	22 16	20 8	20 8	20 40	20 51	105	107
S.H.J.	18 32	11 44	16 56	14 24	16 32	15 38	78	87
Gluyas Early	20 16	19 4	21 4	18 24	21 28	20 3	100	100
Carrabin	17 44	17 20	19 36	14 8	19 20	17 39	88	94
Bencubbin	21 44	22 40	24 8	19 36	23 4	22 14	118	115
Gluyas Early	19 12	18 24	20 0	17 20	19 20	18 51	100	100
Nabawa	20 16	20 32	20 0	18 8	19 44	19 44	105	102

June Planting.

Planted on 20th June, 1934. Germinated immediately. Superphosphate—100 lbs. per acre.
Seed—35 lbs. per acre.

Variety.	Computed Yields per Acre. Sec. 1.	Sec. 2.	Sec. 3.	Sec. 4.	Sec. 5.	Average Yields per acre, 1934.	Percentage Yields, 1934.	Percentage Yields, 1932-34.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	%	%
Noongaar	15 36	15 52	18 0	16 32	15 44	16 21	95	104
Gluyas Early	16 32	16 0	18 32	17 44	16 48	17 7	100	100
Geeralying	15 12	13 44	16 56	15 52	14 16	15 12	89	90
Merredin	18 8	16 0	18 16	17 4	15 4	16 54	100	101
Gluyas Early	17 28	16 40	18 0	16 16	15 44	16 50	100	100
Totadgin	18 32	16 56	19 12	17 44	16 48	17 50	106	109
S.H.J.	13 36	12 56	13 28	14 8	12 16	13 17	74	81
Gluyas Early	18 40	16 8	18 24	18 56	17 52	18 0	100	100
Carrabin	15 52	14 32	11 52	16 0	14 24	14 32	81	88
Bencubbin	18 48	17 44	20 32	19 44	19 4	19 10	109	113
Gluyas Early	17 28	17 12	19 12	16 48	17 36	17 39	100	100
Nabawa	16 56	17 36	18 48	15 52	17 52	17 25	99	102

The very early maturing variety, Noongaar, is shown to advantage in the April sown plots. The yields of all varieties from the plots planted in April and May are better than those planted in June. This confirms the time of seeding experiment which shows that decreased yields can be expected when the planting season is extended into June.

The results show Bencubbin to be the most prolific midseason variety. Of the early maturing varieties. Totadgin is shown to advantage, whilst Noongaar is the more prolific very early maturing variety.

In all plantings, Bencubbin is shown to advantage, followed by Totadgin, except in the plots planted in April.

LUCERNE VARIETIES.

ROW TRIALS AT MURESK.

T. C. DUNNE,
Merchants' Research Officer, Muresk Agricultural College.

A number of instances have been recorded of successes achieved with lucerne under dry conditions. Lucerne has proved quite drought resistant and, being perennial, has the ability to take advantage of the first autumn rains, thus providing a fair amount of early feed. Furthermore, its deep rooting system enables use of the moisture in the lower soil layers so that, at the end of the season, growth may be prolonged for some considerable time after the annual species have dried off.

In 1932, a number of varieties of lucerne were collected and planted with a view to making preliminary comparisons of drought resistance and growth. The following varieties of *Medicago sativa* were included, viz., Hunter River, Marlborough, Tamworth, Mudgee, Tagerim, South African, Provence, Italian, English, Chinese, Mongolian, Poitu, Spanish, Smooth Peruvian, Hairy Peruvian, Montana, Dakota, Kansas, Ladak, Utah, Hardigan, Arizona Common, California Common, North Californian and Grimm. Hardy lucerne, a variety of *Medicago media*, was also included.

The experiment was carried out on a sandy loam soil which had been timbered with jam. The average rainfall at Muresk is 17 to 18 inches per annum, most of which falls during the winter season. The first reliable cropping rains usually occur about the beginning of May and the last useful rains during October. Occasional good falls are sometimes recorded earlier in the autumn.

No supply of moisture was available for summer growth. The plants were not irrigated, and there was no subsoil seepage.

It will be appreciated that, under these conditions, the most desirable varieties would be those which, in addition to being able to survive the dry summer months, were capable of making a reasonable amount of growth during the cooler months of the year. Varieties able to grow only under warm conditions would be unsatisfactory owing to the fact that during most of the warm weather no moisture would be available.

Early rains were received in 1932 and planting was possible on 7th April. The rows were about half a chain in length and were spaced about 18 inches apart. Good germination was secured and all varieties made a satisfactory beginning. Superphosphate was applied at the time of seeding and thereafter each autumn and spring.

It was found possible to cut the varieties three times each year, about the end of June and of September and during November. In a good season four cuts could be secured. Cutting was done when the most forward varieties contained a fair proportion of the plants in flower. At this stage the best varieties were 2ft. 6in. to 3ft. in height. The late September cutting was usually the best. The growth of the better varieties was considered very satisfactory for the conditions.

The best two varieties as shown by the trial were North Californian and Hunter River. The former made a somewhat quicker recovery after cutting and made a little better growth during the colder months. However, the stems of this variety, which tended to become quite hard about the time of the November cutting, appeared to be normally rather coarse. This undesirable feature may possibly have

been overcome by a heavier seeding. Hunter River made quite satisfactory growth throughout the season and had thinner stems and more leaf than North Californian.

Hairy Peruvian, which made satisfactory growth, appeared to be the next best variety. In stem and leaf it was about intermediate between Hunter River and North Californian.

There was little difference in value observed between a number of varieties comprising Marlborough, Mudgee, Tamworth, South African, Smooth Peruvian, and California Common. All appeared to be inferior to those above mentioned.

Practically no winter growth was made by varieties which have been selected for varying degrees of winter hardiness and ability to withstand extremely cold conditions. Any growth made was practically confined to October and November. These included the American varieties, Grimm, Ladak, Utah, Hardigan, Kansas, and Hardy, as well as Tagerim, Chinese, and Mongolian.

All varieties under test were quite drought resistant and were able to keep alive over the dry summer.

The preliminary trials indicate that, under conditions similar to those obtaining at Muresk, it is best to continue with Hunter River lucerne, which has already given satisfaction under a variety of conditions in Australia. More extensive trials may show additional merit in North Californian or Hairy Peruvian for these conditions, but until these are carried out no departure from the Hunter River variety can be recommended.

Owing to the presence of other trials in the same area it was only possible to graze with sheep on one occasion (June, 1934). It is possible that the results may have been somewhat modified were the plants grazed instead of cut, but it is believed that in the main the conclusions would be similar.

The area in which these trials were conducted was rabbit-netted, but during the summer of 1933-34 a few rabbits gained access. A number of plants were dug out by the roots and eaten. It would appear that unless this pest is fairly well under control, extension of lucerne to field conditions would not be successful. It should be profitable, however, to sow small protected areas where early and late green feed is valuable for special purposes.

THE IMPORTANCE OF WATER FOR STOCK.

J. F. Filmer, B.V.Sc.,
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Water is probably the most important single constituent of the diet of any animal. This may perhaps seem rather a sweeping statement, but abundant evidence can be adduced in its support. Fat animals contain less water than those in lean condition—but 40 per cent. of the weight of the fattest pig that ever gladdened the heart of an old-time pork butcher was water. Over 50 per cent. of a fat sheep or a fat bullock is water. Sixty per cent. of a store sheep or bullock is water, and in young animals the percentage is even higher.

Water has many functions to perform in the body. By its aid the food is brought to the right consistency and is thus enabled to pass along the digestive tract. The digestive juices have water as their major constituent. In large herbivorous animals very great volumes of these fluids are secreted. The horse, for example, secretes as much as 10 gallons of saliva daily, while in cattle the volume

may be as much as 15 gallons. The contents of the rumen or paunch of a normal cow contain about 50 per cent. water. If the percentage falls below this, rumination is delayed and finally if the contents become too dry it ceases altogether. Much of the so-called "dry bible" is simply the cessation of rumination due to impaction of the rumen with a mass of food which does not contain sufficient water. No form of treatment which does not ensure the moistening of this inert mass has any chance of success. Most nutrients are absorbed from the digestive tract in solution and are carried through the body in the blood stream. Blood contains approximately 80 per cent. of water and to preserve health this concentration must be kept very constant. In the absence of water the blood draws fluid from the tissues but this source is, of course, limited, and the blood soon becomes concentrated. Death rapidly follows, especially in working horses.

Most of the waste products are removed from the body in watery solutions either as urine or sweat. The evaporation of sweat assists materially in controlling the temperature of the body. Finally the elasticity of the body tissues depends very largely on their water content. This is easily recognised when the wonderful resilience of the skin and muscles of a live animal are contrasted with those same tissues after they have been dried by exposure to the sun.

Enough has been said to show the extreme importance of water in animal nutrition. It is, therefore, not surprising to find that serious results follow the withholding of adequate amounts of water. An animal can live much longer without solid food than it can without water. As much as 50 per cent. of the nitrogenous matter and all of the fat of the body may be lost from starvation without death ensuing, but if 10 per cent. of the water of the body is lost the animal dies.

The quantity of water required by stock varies widely. It is influenced by temperature, humidity, the moisture content of the food, the work being performed and the amount of milk being secreted. A working horse in hot weather requires about 10 gallons daily, but much less will suffice for a horse in the paddock, especially if the pasture is green. Dry cows and steers in summer drink up to 10 gallons per day. Dairy cows grazing on green pasture need about two gallons of water daily for every gallon of milk produced. On dry feed about double this amount is needed. This means that high producing cows at times require very large amounts of water. It is on record, for example, that a Fresian cow producing 10 gallons of milk drank between 20 and 30 gallons of water daily. Calves on skim milk will drink from one to two gallons of water on hot days. Sheep on green pasture seldom drink at all, but on dry feed in hot weather they may drink up to six quarts per day.

The quality of water supplied is almost as important as the quantity. In Western Australia the salt content of stock water is often of importance. There is a rather wide variation between the different farm animals in regard to their tolerance of saline waters. For horses, water should not contain more than one ounce of salt and other mineral matter per gallon; cattle will tolerate up to one and a half ounces per gallon, and sheep have been successfully watered from sources where as much as two and a half ounces per gallon were present. Pigs and poultry should both have water that has a low salt content. There is a tendency in some quarters to consider that it is necessary for good stock water to contain a certain quantity of minerals. This is probably because in human dietary water is often a not unimportant source of such substances as iodine and lime. With grazing stock, however, the minerals in water are negligible in amount when compared with those present in good sound pasture, and uncontaminated rain water may be regarded as ideal for all classes of stock.

Water should be palatable. This is of great importance. Any cause which prevents an animal from drinking, whether it be taste, smell, colour, temperature, sediment, slime or even situation must be removed. Even water which the analyst has declared ideal stock water, and which is wholesome in every way, will prove quite useless if for any reason stock refuse to drink it. Sometimes factors which render water unpalatable can be removed. For example, the temperature can be reduced by shade; sediment can sometimes be removed by concreting a watering place in a stream, or by pumping into troughs, or by the use of lime; slime can be removed by regular washing of troughs. But if unpalatability of the water cannot be corrected and stock, after a fair trial, refuse to drink adequate quantities then a fresh source must be sought.

Water should never be contaminated with animal excreta. There are fortunately few animal diseases present in Australia which are likely to be spread in this way, but the danger of intestinal parasites being transmitted is a very real one. Care should be taken to see that stable drainage and that from heavily stocked paddocks do not find their way into dams. The avoidance of the fouling of dams and other water supplies by pumping into troughs well away from the banks is a practice which should be adopted wherever possible.

In other countries and in other Australian States liver fluke is a serious problem. The larval stage of this parasite lives in a water snail and it is necessary to guard against sheep and cattle watering from swamps where this snail is present. Fortunately we are not cursed in Western Australia with this pest.

The possibility of the transmission of disease through water troughs and other watering places must always be borne in mind. This applies especially to diseases like strangles where there is a discharge from the nostrils. Animals suffering from these diseases should always be watered from a special bucket or other receptacle kept for the affected animals only, and such buckets, etc., should never be dipped into the common water supply. Quite recently it was shown in the Perth Veterinary Laboratory that toxic paralysis could be contracted from water contaminated with carrion. For this reason care should be taken to keep carcases out of dams, creeks, wells, etc. Crows have been known to drop carrion into water troughs, and care should be taken to drain and clean troughs which have been fouled in this way.

Contamination of the water supply of dairy cows must be guarded against scrupulously. Two cases in which milk developed ropy clots were reported in a recent veterinary journal. Both were traced to water contaminated, in one case from kitchen sinks and in the other from sewerage. Correction of these defects remedied the condition of the milk in both cases.

The times and methods of supplying water to stock are of very considerable importance. A great deal has been written concerning the times at which horses should be watered and it is generally recommended that water should be given before food. The reason advanced is that if given after the food the water washes the undigested food from the stomach into the intestines. Experiments have not altogether confirmed this theory and it has been shown that horses may be watered regularly after feeding without ill effects from indigestion resulting. The practice of watering before feeding is a good one, however, and has much to recommend it. This applies especially to the mid-day and evening feeds. Remember that a thirsty horse will not eat well until his thirst has been slaked. But horses will seldom drink in the early morning in winter and it is then largely a waste of time taking them to water before feeding. Fast working horses should not be given large drinks of water immediately before commencing a journey, as this often causes rather severe

purging. On long journeys, however, small drinks at intervals are necessary and seldom do any harm, especially if the horses are taken quietly for the first mile after a drink. Horses should not be given large drinks of cold water when very hot and distressed. It is, however, a good practice to water horses at the end of a journey or a day's work, provided they are not in a distressed condition. It is indeed preferable to waiting until they have become cold and stiff. It is difficult to lay down hard and fast rules, but these principles should be observed where possible. When regular work is being done water the horses regularly. Farm horses should, where possible, be given free access to water during the night when working and at all times when spelling.

To dairy cows water should be available at all times. Depriving cows of water for long periods is a very potent factor in lowering milk production. It has been experimentally shown that cows which are watered only once or twice a day produce considerably less milk than those which have constant access to water, even though, as sometimes happens, they actually drink more water.

Sick animals should, in almost every instance, be encouraged to drink. This applies to some cases in which popular tradition is emphatic that water should be withheld, *e.g.*, wheat founder in horses. In almost all forms of illness there is a tendency for toxins to accumulate in the body, and it is impossible to flush these out of the body unless the animal drinks copiously. With the possible exception of animals which have had access to plant poisons, I can think of no disease in which water should be withheld.

One may sum up by saying that water for stock should be pure, wholesome, palatable and readily accessible in ample quantities.

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NOTES ON THE CHEMICAL COMPOSITION OF SALTBUSHES FROM THE SALMON GUMS AREA.

In June, 1934, when visiting the Salmon Gums area, the Hon. Minister for Lands (Mr. M. F. Troy) was attracted by two species of saltbushes growing on some of the unsatisfactory soils of the district. The species were collected by the author on two holdings east of Red Lake and identified by the Government Botanist (Mr. C. A. Gardner) as *Atriplex prostratum*, a low plant from 6 to 9 inches tall, in colour, sage green suffused with purple, and *Atriplex halimoides*, an erect, grey-green mealy-leafed type from 12 inches to 18 inches tall.

In the Salmon Gums district both species grow well on the Beete calcareous sandy loam, known locally as "kopi." This soil is very unsatisfactory for wheat growing but appears to have distinct possibilities for pasture production. Wimmera rye grass (*Lolium subulatum*) grows well on this soil type, and the saltbushes should be a valuable adjunct to the grazing which this and other grasses provide.

The stock are reported to eat these saltbushes sparingly, particularly when they predominate in the pasture available. As a supplement to stubble grazing they will probably be of considerable value on account of their mineral and protein contents.

The analyses reported in Table I. were made in the Government Chemical Laboratory and illustrate the general properties of this genus.

Table I.

Chemical composition of two species of Saltbush from the Salmon Gums Area. Reported as percentages on the oven dry basis.

Species.	*Atriplex prostratum.*	*Atriplex halimoides.*
Fitzgerald Location	148	401
Constituents—	%	%
Nitrogen (N)	2.75	2.17
Protein (N x 6.25)	17.18	13.56
Crude fat*	1.71	1.94
Crude fibre	10.54	14.07
Nitrogen free extract	45.51	37.89
Total ash	25.06	32.54
Guthrie's Unit value†	66.54	55.82
Mineral constituents in the dried plant material—		
Silica, SiO_2	5.24	2.16
Ferric oxide, Fe_2O_3	0.31	0.17
Calcium oxide, CaO	2.04	1.89
Magnesium oxide, MgO	2.15	2.20
Sodium oxide, Na_2O	5.70	10.79
Potassium oxide, K_2O	2.34	1.89
Carbonic oxide, CO_2	1.24	3.08
Phosphoric oxide, P_2O_5	0.35	0.28
Sulphuric oxide, SO_3	0.35	0.48
Chlorine, Cl	5.26	11.72
Copper, Cu	0.0052	0.0062
Manganese oxide, Mn_3O_4	0.0157	0.0128

—Analyst, G. E. M. Dean.

* Determined by extraction with petroleum ether.

† *Guthrie's unit value* is the sum of per cent. protein plus per cent. nitrogen free extract plus per cent. crude fat multiplied by 2.25. Crude fibre, which will have some feed value, is not included in this figure.

The analyses show that these saltbushes are rich in protein, the quantity being comparable with good lucerne hay. As the digestibility of the various constituents is not known the albuminoid ratio cannot be determined. If it be assumed that the digestibility of the various food constituents be the same, some idea of the probable order of magnitude of the albuminoid ratio can be determined by considering ratio of the percentage of protein to the sum of the percentage of the nitrogen free extract plus the percentage of crude fibre plus the percentage of crude fat multiplied by 2.3.

This figure for the specimen of *Atriplex prostratum* is 1 : 3.5; for *A. halimoides* is 1 : 4.2, which are very favourable, comparing in numerical magnitude with the *true* albuminoid ratio for peas, bran, etc.

Unfortunately both specimens are quite low with respect to phosphoric oxide, and cannot be expected to assist in correcting any phosphatic deficiency.

In common with many other specimens of Atriplex examined, the ash of these plants is extraordinarily high and a feature of the ash is the high content of sodium and chlorine. On the equivalent basis the specimens contain 0.184 and 0.330 equivalents respectively of sodium and 0.148 and 0.330 equivalents respectively of chlorine per cent. Assuming that all of the chlorine is combined with sodium as sodium chloride, the plants would contain 8.65 and 19.3 per cent. sodium chloride respectively on the dry basis. This content of salt (sodium chloride) would be an important factor in limiting the quantity of these fodders consumed by plants.

[L. J. H. Teakle, Plant Nutrition Officer, Department of Agriculture.]

PASTURE NURSERY PLOTS.

G. K. BARON-HAY,

Superintendent of Dairying.

In 1932 a scheme of establishing pasture nursery plots throughout the State with a view to ascertaining information regarding the most suitable types of pasture plants for each district was discussed and inaugurated by officers of Cuming Smith & Mt. Lyell Farmers' Fertilisers Ltd. and the Department of Agriculture. It also was hoped that, should any of the plants used prove specially suited to a district, the farmer would be able to obtain seed from the nursery plot in order to sow larger areas, as at that time pasture seeds of approved strains were very high in price. These nursery plots have been conducted for three full seasons, and it is believed that, owing to the definite information which has been obtained and is given below, their continuance by the Department is not warranted.

The accompanying map shows the south-west portion of the State divided into seven zones, in each of which a number of nursery plots were instituted.

The following perennial pasture plants were sown:—Western Districts Perennial Ryegrass, Akaroa Cocksfoot, Phalaris tuberosa, New Zealand White Clover.

All plots were fertilised at planting with super. and ammonia No. 3 at the rate of 300 lb. per acre and again in April, 1933, and 1934 with the same fertiliser.

RESULTS.

Zone 1.—Centre, Waroona. Rainfall, 30-40 inches.

Perennial Ryegrass.—Unsuccessful on non-irrigated areas. Very persistent under irrigation but generally not thrifty unless soil is rich in humus.

Cocksfoot.—Not recommended for non-irrigated areas, but can be used in mixtures on irrigation lands.

Phalaris tuberosa.—This grass was the most outstanding one in the trials on both irrigated and dry lands. It showed a vigorous healthy growth during the second and third years, producing a bulk of good feed throughout the season.

White Clover.—With the exception of very moist summer land, the only areas where this clover will succeed are those that are irrigated.

Zone 2.—Centre, Burekup. Rainfall, 40 inches.

Perennial Ryegrass.—Good results were obtained in this zone on alluvial soils rich in humus, either irrigated or retaining summer moisture.

Akaroa Cocksfoot.—This grass proved unsuited for the average conditions in Zone 2.

Phalaris tuberosa.—This grass was most outstanding and is the most promising perennial yet tried in this zone.

White Clover.—On irrigated areas and summer moist land, good results were obtained provided spring planting was adopted. Autumn planting generally fails owing to the severity of attacks of lucerne flea and red mite.

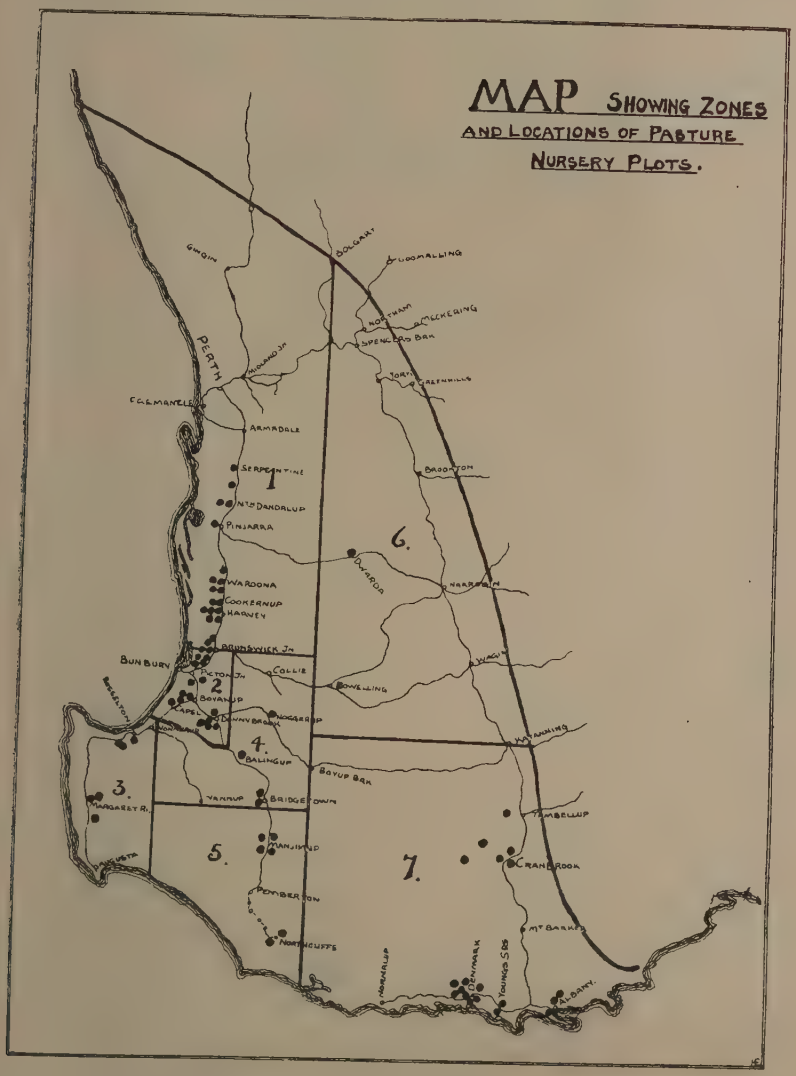
Zone 3.—Centre, Margaret River. Rainfall 30-40 inches.

Perennial Ryegrass.—Generally not recommended unless the soil is thoroughly drained and fertile.

Cocksfoot.—Recommended for hillsides only in the areas South of Margaret River.

Phalaris tuberosa.—This grass is recommended for those soils which have a clay subsoil and retain their summer moisture.

White Clover.—This clover establishes itself successfully in this area provided lucerne flea and red mite infestation are not severe.



Zone 4.—Centre, Donnybrook. Rainfall, 30 inches.

Perennial Ryegrass.—The persistency of this grass was higher in this zone than elsewhere, and on the more fertile soils good results were obtained.

Cocksfoot.—Not generally recommended for this zone, as only odd plants survived the summer conditions.

Phalaris tuberosa.—Establishes itself well and has given consistently good results in this area, provided that weed competition is controlled during the first year, its use is recommended for this area.

Zone 5.—Centre, Manjimup. Rainfall, 30-40 inches.

Perennial Ryegrass.—Good results were obtained and sowing is recommended on the more fertile soils.

Cocksfoot.—This grass is recommended for the hillside areas in this zone.

Phalaris tuberosa.—No definite information can be given with regard to this grass in this zone, and further trials will be conducted.

White Clover.—Recommended for the soils which retain their summer moisture.

Zone 6.—Centre, Dwarda. Rainfall, 24 inches.

Perennial Ryegrass, Cocksfoot, and *White Clover* are not recommended for this area except in very isolated places which are fertile and retain their moisture during the summer months.

Phalaris tuberosa has given the most promise of success.

Zone 7.—Tambellup to Denmark. Rainfall, 20-40 inches.

Perennial Ryegrass.—Recommended for the more fertile soils in the high rainfall areas.

Cocksfoot.—This grass is successful on the light loamy slopes in the high rainfall areas.

Phalaris tuberosa.—Under all climatic and soil conditions this grass was outstanding. It is recommended for this zone on soils where a clayey subsoil is obtainable.

White Clover.—This clover is recommended for inclusion in all seed mixtures in the high rainfall areas of this zone.

GENERAL RECOMMENDATIONS.

Perennial Ryegrass may be planted on soils which are high in humus and retain summer moisture or are irrigated.

Phalaris tuberosa should be sown on a well prepared seed bed reasonably free from weeds, as severe weed competition during its first year may cause a complete failure. It has given consistently good results throughout the South-West districts.

White Clover.—In those areas where lucerne flea and red mite are severe, autumn sowing of this clover is not recommended as a complete failure may result.

THE INTER-RELATIONSHIP BETWEEN BIRDS AND MAN.

C. F. H. Jenkins, B.A., R.A.O.U.,
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The complex inter-relationships which exist between the members of the animal kingdom are usually so well adjusted that their existence is overlooked, and it is only when something happens to upset the rhythmic working of this system that we appreciate its delicate balance, and the impotence of our efforts to put things right.

The importance of insects in the natural scheme of things is driven home by the hordes of noxious species which force themselves upon our notice, but the rôle played by birds, although less conspicuous, is none the less important.

In his early days man regarded birds as an important source of food, and perhaps of clothing, and although to-day the indebtedness is less apparent it is none the less real. Even to-day birds constitute an important article of food to civilised and native races, in fact so important were they found to be in New Zealand, that the Government deemed it necessary to pay a large sum to the Maoris of a certain district as compensation for the drainage of extensive swamps which were the home of the now rare brown duck.

Another instance of direct utility to man may be taken from the mutton-bird industry in the Bass Strait islands, where many thousands of eggs are gathered and marketed annually together with consignments of smoked birds.

This industry is now a carefully regulated one, and should prove to be a permanent source of wealth to those engaging in it, although in its early days the indescriminate exploitation of the rookeries, as the breeding grounds are called, threatened the very existence of the species.

It is sufficient just to mention the vast guano deposits which may be found on many oceanic islands to bring to mind the importance of birds in maintaining the fertility of our soils; and the project has been seriously considered of introducing some of the more prolific guano producing species into our local seas so that in years to come Australia may have supplies of fertiliser near at hand.

Instances showing the importance of birds to a specific few may be cited almost indefinitely. Until recent years plume hunting was quite an important industry, and traffic in various avian products is more or less continuously carried on, but it is the more important, though indirect services which birds render to man which are worth most consideration.

The foregoing examples are insignificant when compared with the importance of birds in controlling the numbers of the lower animals, and it is owing to their untiring efforts in this direction that we find life upon the earth at all tolerable. All birds, of course, are not wholly useful, and a few are really injurious, but many popular culprits by no means warrant their bad reputations.

Birds like the swallow, the robin, and the wagtail are too well known to need any eulogy, but other less known species such as the magpie lark, the pardalotes, and the cuckoos are equally valuable.

The magpie lark is of particular interest to the pastoralists in various parts of the Eastern States, where that dread parasite of sheep —the liver fluke —occurs, for by feeding upon the fresh water snails, which constitute the alternate host of this parasite, its ability to multiply is appreciably checked.

The little pardalote is widespread in all the timbered areas of the Continent, but spends its time hunting for insects in the leafy tops of the trees, and usually its monotonous call is the only intimation of its presence. Its absence, however, is very quickly reflected by the forest trees, and the death of many fine eucalypts in the park lands surrounding Adelaide has been traced to the ravages of insect pests present in unusual numbers due to the disappearance of this tiny and beautiful bird.

The cuckoos are viewed with distaste by some people because of the murderous habits of their young, for the baby cuckoo ejects its foster brethren from the nest at the first opportunity; but although by this means many useful insect-eaters come to an untimely end, the cuckoo's liking for various hairy caterpillers, highly distastful to other birds, makes it rank as an important vermin destroyer, and compensates for its less commendable habits.

Before passing to the really destructive species, I will deal with a few which have been rather severely handled by popular opinion, and whose evil reputations are based upon extremely doubtful evidence.

Silvereyes, crows, hawks, shags, and black cockatoos will serve as examples.

The silvereye, it is true, takes its toll of grapes and soft fruits during the season, but throughout the remainder of the year it hunts assiduously for aphis, mealy bug, and similar pests, the ravages of which cause far heavier losses than those sustained from the pecked fruits.

The crow, as is generally known, will attack lambs and weak sheep, but its services as a scavenger are usually overlooked. It is doubtful whether the damage done to healthy animals is at all considerable, and when it is remembered that the loss to the wool industry from the blowfly pest, in New South Wales alone, has been estimated at £2,000,000 per annum, the services of any ally against such a scourge should not be lightly cast aside.

The poultry farmer is the sworn enemy of all hawks, and produces a gun whenever any member of the hawk family comes in sight, but this bitter enmity is by no means justified. The sparrow hawk and the goshawk, both small, swift flying species, are notorious chicken stealers, but the majority of the others are carrion or vermin feeders, and should be encouraged.

Any one who has seen a party of black cockatoos stripping the trees of bark and strewing the ground with litter would think that the forester had ample justification for resenting the presence of these birds, but a little investigation will show that there is a strong case to be presented in their favour. These cockatoos perform the service in Australian forests which the woodpeckers do in those of the old and new worlds, and although in their search for wood-boring grubs they gash the limbs about in a reckless manner, the timber is already spoiled for commercial purposes, and by devouring the original culprits they are helping to maintain the health of other uninfected trees.

With the possible exception of some of the parrots, there are few native birds whose indiscriminate destruction can be recommended, but when we consider the introduced varieties it is quite another story, and it is then the serious consequences man's interference with the balance of nature can bring about becomes apparent.

A classical example is presented by Charles Elton in his book on Animal Ecology.

Some keen gardener introduced into Hawaii a species of Mexican lantana, which in its native home caused no trouble to any body. Meanwhile someone else imported to the islands a number of turtle-doves from China, which showed

a great liking for the berries of the lantana. Indian minahs were also introduced, and the two birds were instrumental in spreading the plant throughout the country. But this is not all. The grasslands and young canefields had formerly been ravaged annually by hordes of army worm caterpillars which also served as food for the minahs, and the increase of the latter bird acted as an important check upon the insect plagues. About this time parasites were introduced upon the lantana, and the weed began to decrease. As a result the minahs also began to diminish in numbers, and the army worms to appear again in the crops. In addition it was found that when the lantana had been removed, other introduced weeds took its place, often more difficult to eradicate than the original shrub.

Such an example is only one of many, and it is not difficult to find them nearer home. In fact Australia and New Zealand probably illustrate better than any other countries in the world how easily the balance between man and the lower animals may be upset and with what disastrous results. Deer introduced into New Zealand roam the forests in vast herds, and have completely stripped the undergrowth in many places, thus upsetting the environment of the native birds. Not satisfied with this, civilisation has brought with it numerous foreign birds like the goldfinch and the starling, many of which have overrun the country, practically ousting its lawful avian inhabitants. The blackberry is an ever-increasing pest in the Dominion, and the starling, one of the chief factors in its dispersal, must be eradicated before the weed can be controlled.

In Western Australia introductions are as yet few and unimportant. The hordes of sparrows, starlings, goldfinches, blackbirds and thrushes which plague orchardists in the neighbouring States, are here unknown. Our most numerous foreigner is the kookaburra, which has already increased with rather alarming rapidity in certain districts. The goldfinch has just obtained a footing, while the Indian and the African turtle doves so numerous around the suburbs are annually spreading further and further over the State.

The driving out of native species by foreigners may have even more far-reaching effect than already cited, for it is the feathered population, and more especially its honey-eating members, that we in Western Australia must thank for much of our characteristic flora. Apart from controlling insect pests birds serve as important agents in cross-fertilisation, and such unique plants as the kangaroo paws owe their very existence to the little honey-eaters which tend them. Insect visitors are not lacking but the flowers are so constructed that birds alone can transpose the pollen grains, and banksias, gravilleas and even eucalypts look to birds for pollenation. It has been said with considerable truth that were the honey eaters to be exterminated Australian eucalypt forests would likewise perish, and it is certainly true that many of the smaller plants would find reproduction impossible.

The importance of native species will now be apparent, and although foreign forms may have a certain appeal they should be viewed with suspicion one and all.

The fact that a bird is not harmful in its native country is no guarantee for its behaviour elsewhere, and removed from the natural checks of its normal environment its numbers may attain serious dimensions in a very short time. The European birds introduced into Australia have not the hardships of winter to contend with to which they have been accustomed, and may be found rearing broods of young any month in the year, so that it is small wonder their native competitors fall back before them.

With the spread of civilisation the depletion of certain members of the bird population is inevitable, for species like the mallee hen and the bronzewing pigeon are essentially lovers of cover and must be driven back as the land is cleared, but what is disastrous to one may be advantageous to another, and magpies, ground larks and quails will increase as fresh land is thrown into cultivation. The diminution of certain species through the advance of settlement we are powerless to prevent, but the drop in numbers resulting from deliberate destruction, or from the introduction of pests like the fox and the cat, is a matter over which we have, or did have, some control. Unfortunately in many cases it is too late to rectify the errors already made, but if they serve as guides for future action, and make us realise the value of our feathered population, much may still be done to preserve in our own State the balance which has been elsewhere so rudely shaken.

FIG LEAF MOTTLE.

H. A. PITTMAN, B.A., B.Sc.Agr.(Hons.), Plant Pathologist,
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The condition known as "fig-leaf mottle," which is characterized by a mosaic-like pattern of light green, or yellowish, and dark green patches on affected leaves, is exceedingly common in the metropolitan area and other parts of Western Australia, where it appears to be increasing in extent from year to year. Associated with the mottling (which can be seen more clearly if the leaves are held up to the light), is frequently a certain amount of distortion and malformation of the leaves.

The exact cause of the disease is not known, but it is considered to be due either to some unsatisfactory soil condition, or to the presence in the sap of affected plants of an ultramicroscopic parasite or virus, which is carried about from plant to plant by means of some sucking insect.

This disease not only affects the leaves but frequently causes the first crop of figs to fall away without developing normally, and it may interfere also, at times, with the development of a considerable proportion of the second crop.

While its exact cause is not known, it has been found in practice, from observations extending over a number of years, that very considerable improvement may be brought about by adding from one to four lbs. of finely crushed bluestone (copper sulphate) to the soil beneath each affected tree, the exact amount used depending on the size of the tree. The bluestone should be applied from a foot or so away from the trunk, all around the tree, as far out as the branches extend, preferably in the autumn, and shortly after the advent of the heavy autumn rains. It can also be used in the spring or at any other time of the year, providing the soil is quite moist when it is applied; but in this case its effects may not become apparent till the next season. Care should be taken not to put any great quantity of bluestone on any one spot, or its poisonous action may prove injurious to the roots in that area, and consequently to a greater or less amount of the top of the tree. A very finely crystalline form of bluestone, known as "bluestone fines," is very convenient for distributing, and requires no extra grinding before being applied. It also readily dissolves in cold water.

After the first application, a quantity of bluestone, equal to about one-quarter of that which was applied in the first year, should be applied each following year in the autumn, the same technique being followed as in the first year of application.

THE PINEAPPLE.

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The pineapple can be grown on an extremely wide range of soils where the land possesses good drainage. The Gascoyne soils lend themselves rather favourably towards the commercial growing of this fruit, providing attention is paid to the building up of soil humus and the application of a suitable manurial mixture. Pineapples can be grown successfully on soils low in available plant food but which are of a loose and open nature and free from water logging. Successful results have been obtained in Eastern parts of Australia on land considered too poor for the cultivation of other crops. On very rich soils, those containing a large amount of humus and available plant food, the fruit has a tendency towards oversize, poor flavour, and sloppy flesh with consequent poor shipping and marketing qualities. The chief requirements of the pineapple, therefore, are a soil of a friable nature possessing a naturally well drained subsoil, in a sheltered position free from frosts and boisterous winds.

SOIL AND PREPARATIONS.

The land should be cleared, all roots being removed to a depth of 15-18 inches, and cross ploughed, and the surface soil reduced to a fine tilth. The value of strict attention to the initial preparation of the land will be revealed shortly after planting. By a thorough preparation of the soil the young plant makes rapid progress which is highly desirable, for the quickly established plant will produce earlier and better fruit.

As pineapples are planted close together it is essential that the land should be free from weeds and grasses, especially couch and nut grass, otherwise the cost of keeping the land clean will be almost prohibitive, as practically all the work in the vicinity of the plants must be carried out by hand.

MANURING.

An analysis of the pineapple indicates that it is a distinct potash feeder, so when considering a suitable manurial mixture we must bear in mind that potash must be the dominating ingredient. At planting, a manurial mixture, such as 3 cwt. sulphate of ammonia, 5 cwt. of superphosphate and 1 cwt. of potash may be given to the beds, and annual applications of sheep manure can be applied to the rows to assist in maintaining "body" in the soil. At the same time, sheep manure will be found to contain a percentage of potash.

A spring application of 3 cwt. sulphate of ammonia, 5 cwt. of superphosphate and 1 cwt sulphate or muriate of potash will be found greatly beneficial.

PROPAGATION METHODS.

The most popular type of plant used to commence the plantation is a sucker which shoots from the base of the plant (Fig. 1a), as it comes into bearing much earlier than other types. The "nib," "robber" or gill sprout (Fig. 1b.) is also popular amongst many growers as it is claimed to produce a better first fruit than a sucker, although taking several months longer to come into bearing. The nib or gill sprout develops from buds at the base of the fruit and along the fruit stalk. The "crown" or "top" (Fig. 1c) can be used for propagation purposes, but this type of plant takes longer than the nib and possibly more than two years may

elapse before the fruit is matured. In Hawaii large acreages were planted with crowns removed from the fruit prior to moving the pine to the canneries, but this is impossible in Western Australia as the crown must remain on the fruit when shipped to market.

Prior to planting, the leaves should be stripped from the base of the sucker, thus giving the roots a better chance to develop and spread into the soil. When planting nibs the bulb at the base of the nib should be cut off and the base leaves

Fig. 1.—Showing the different parts of the plant used for propagation purposes.
A, Sucker. B, Nib or Robber. C, Crown or Top.

removed. This stripping of lower leaves also applies in preparing crowns for planting. It will be found advantageous to allow fresh plants to sweat for a week or two prior to planting.

When plants are required to be moved long distances it is permissible to cut back the leaves, thus avoiding damage to young centre leaves and allowing the plants to be bagged more firmly and consequently reduce the bulk. Although this practice is strongly opposed by many authorities, several examples have been noted where "cut" plants have developed and matured fruit equally as good as plants which have not been cut. However, for local propagation purposes, it is advisable to avoid as much as possible the breaking or damaging of the leaves.

PLANTING.

Time of Planting.

Planting nibs in March should receive consideration, for planting of nibs at that time will result in good cropping for September, eighteen months later, whereas if planted in early summer the main crop is not ready for harvesting until towards the twenty-fourth month.

Planting can be carried out on the Gascoyne in early spring so as to afford the young plants an opportunity to make a sound root development before summer.

Fig. 2.—Illustrating position of plants in the basins.

Method.

There are several methods of planting, viz.: single rows, double rows and check planting, and where the double row method has been adopted it can be retained. Once the land has been thoroughly tilled and levelled the position of the beds should be pegged out. The beds should be made basin shaped, about 36 inches wide and having sloping sides gradually rather than abruptly as in a ditch. The plants should be planted two to three inches deep, according to size, on the rising sides of the basin, about 18-20 inches apart with approximately 24 inches between the two rows. The plants should be placed alternately or "staggered"—*i.e.*, with those in one row opposite a point midway between those in the other. (Fig. 2.)

After planting, the soil should be pressed firmly around the young plant with the foot, and special care should be taken to prevent the soil entering the crown or heart leaves of the plant, as this will greatly retard the growth and progress of the plant. This point should also be kept in mind during irrigation. Do not flood the basin so that the water inundates the crown or heart leaves. (Fig. 3.)

Although the basin method is quite suitable for irrigation purposes during the first year or so it is believed that irrigation difficulties may arise after this period in that the basin is likely to silt up and flooding the rows of pines will be difficult. As an alternative, check planting is suggested. The land should be laid out in blocks of about 10 feet, and instead of the double row of pines, four rows should

be planted staggered fashion, each row of pines being 2 feet apart with 18 inches between each plant. The sides of the check should be mounded up and the first row of pines planted 2 feet in from the mound.

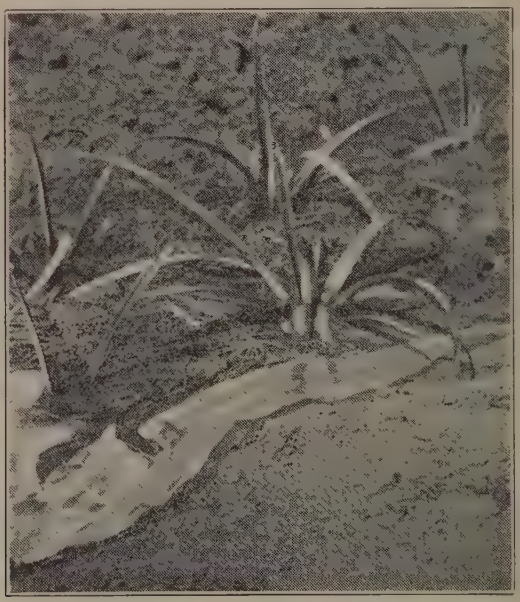


Fig. 3.—*Pines flooded.* Note water and silt entering heart leaves of plants.

Fig. 4.—Nibs planted under paper mulch.

Consideration should also be given to the adoption of some overhead or sprinkler system of irrigation which would somewhat alleviate the difficulties mentioned where the basin method is in vogue.

PAPER MULCH.

In recent years the use of what is commonly referred to as "paper" mulch has come into prominence (Fig. 4) as it considerably reduces the amount of cultivation and weeding and tends to conserve soil moisture. This material, which is put up in rolls 300 feet long by three feet wide, has been extensively used in the Hawaiian Island during the past ten years and was becoming increasingly popular in Queensland until importation was discontinued on account of the cost. It is claimed by users that, apart from reducing cultivation costs, the crop matures earlier, and there are heavier yields of larger fruit.

Consideration might be given to using this material with overhead irrigation and also by using it in the basin system with flooding should supplies again become available.

IRRIGATION AND CULTIVATION.

The pineapple will thrive on less water than the banana but should not on this account be neglected in regard to irrigation. A good policy would be to irrigate the pineapple at every second irrigation of the banana and in lieu of every other irrigation the pineapple rows could be cultivated and chipped with the dutch or pineapple hoe.

As the pineapple plant has a shallow root system it is necessary that cultivation around and close to the plant must be carried out by hand, preferably with the dutch or pineapple hoe, care being taken to replace the soil around the plants. The pineapple, like most other plants, will show encouraging response to cultivation and when kept free from weeds.

ELIMINATING SURPLUS GROWTH.

Just as fruit trees need pruning and bananas desuckering, similarly the pineapple requires attention, otherwise the suckers become so plentiful that the plant weakens and is unable to produce quality fruit. A discreet thinning out of suckers is recommended, leaving the healthiest, strongest and most evenly spaced plants to bear the following crop. All nibs or robbers should be removed and once a sucker has produced a fruit the old stump or the portion of the stump above a strong sucker should be removed. Always encourage the development of ment of suckers near the ground so that roots will be produced.

The thinning or pruning of the pineapple rows should be done in the winter and suitable plants can be selected from the "prunings" for the spring planting. In Queensland some growers collect all suitable planting material at pruning time and stack the plants away under cover, while others prefer to place all suitable plants in a nursery bed. The latter method is advantageous in that the lower leaflets decay and the plants commence their rooting system so that at planting out expenditure of time and labour in removing the bottom leaves is saved. With the very vigorous nib-producing varieties some growers remove these immediately after harvesting and place them in the nursery bed for spring planting.

HARVESTING, PACKING AND MARKETING.

From flower to harvesting, a period of 20-24 weeks elapses, depending on variety. At harvesting every care should be taken in handling the fruit because every knock or bump the apparently hard green fruit sustains will reveal itself when the fruit is fully ripe as a bruise and discoloured flesh, which may decay and affect not only the injured but also adjacent fruit.

The fruit should not be pulled or plucked from the plant but the fruit stalks should be cut with a knife several inches below the base of the fruit. The stalk is then cut back to about a quarter of an inch from the base.

The fruit should not lie on the ground or in the sun but should be conveyed as quickly as possible to the packing house and stacked on the crowns (up-side down) until packing time.

The actual stage of ripeness at which the fruit should be picked varies with the variety and season—summer or winter, but experience will quickly promote judgment on this matter. It must be recognised that immature fruit will never develop the luscious pineapple flavour while fruit cut too late will have an over-ripe or fermented flavour. Naturally such quality fruit will prove unprofitable no matter what care and attention is given to harvesting and packing.

As a guide it might be said that summer fruit are ready for shipping to Southern markets when the "eyes" are well filled and the lower "eyes" are changing from green to pale yellow. The fruit should be better coloured for winter markets otherwise the sugar content will be low.

If possible the fruit should be allowed to stand in the packing house for 12 to 24 hours and must never be packed while hot or wet.

The fruit should be graded for size and degree of ripeness—nothing detracts more from a case of good quality fruit than irregular size and varying degrees of ripeness. The fruit can be packed in the banana case (Tropical), the inside measurements of which should be 24¾ inches long, 12 inches wide and 12 inches deep. Slack packing should be avoided; it is best to pack the case so that there is a slight bulge when the lid is nailed on. A layer of wood-wool, straw, dry grass or banana trash should be placed on the bottom of the inside of the case, between each tier and on top of the last layer of fruit.

Close attention must be paid to the protection of the fruit from sunburn during the summer months and to this end it should be covered with pieces of hessian. On account of the winds experienced on the Gascoyne it will be necessary to fasten the hessian with wire (copper wire for preference).

All sunburnt or otherwise affected fruit should be removed from the plantation immediately it is detected. Damaged or decaying fruit are a harbour for beetles and other pests which in time may attack healthy fruits.

DISEASES.

As the industry is new to Western Australia the State is practically free of diseases and this condition should be maintained by hygienic methods in the plantations. On the discovery of any suspicious indications the grower should inform the Departmental Adviser or forward specimens to the Department of Agriculture, Perth.

VARIETIES.

There are many varieties of pineapples but for commercial purposes the most widely grown are smooth leaved Cayenne, Queen, and Riply Queen, which are good croppers, the best flavoured, the hardiest, and the best shippers.

Smooth-leaved Cayenne is possibly the most popular of all pines and used extensively for canning purposes. The leaves are long and smooth or with very few spikes, broad and dark green; the flowers are purple, fruit very large, large crowned, dark orange yellow; flesh pale yellow, rich, highly flavoured; pips large and flat. Does not sucker so freely as other varieties but develops abundance of nibs. Weight, 6-10 lbs.

Queen is free growing and compact, coming quickly to maturity. The fruit is of an attractive deep yellow colour, very juicy, the flesh pale yellow, of refined flavour and keeps well. Flowers lilac and fruits weigh from 3 to 6 lbs.

Riply Queen is not as consistent a bearer as the Queen, having one main crop and several "off crops." Ripens earlier than the Queen and has excellent flavour. Flowers purple. Fruit roundish ovate, slightly compressed at either end and of pale copper colour when ripe; flesh yellow, firm, rich and very sweet. Weighs from 3 to 6 lbs. Matures about 22 weeks after flowering.

FUNGICIDAL AND INSECTICIDAL DUSTS FOR USE IN MARKET GARDENS.

H. A. Pittman, Plant Pathologist, and
L. J. Newman, Government Entomologist.

For various reasons the growers of market-garden produce such as tomatoes, cabbages, cauliflowers, pumpkins, water melons, celery, potatoes, etc., frequently prefer to use dust forms of insecticides and fungicides rather than wet sprays. Thus, although the cost of the materials for dry dusting is very much more per acre than is the case when reliance is placed on sprays, yet the greater convenience of the dusts, in many ways, and their very much greater ease of application, combined with the rapidity with which they can be applied to fairly large areas, make a big appeal to many growers.

So many requests have been received from growers during recent years for formulae for suitable dust mixtures, that it has been deemed advisable to issue, in printed form, certain of the formulae which have been previously available only on duplicated sheets.

No claim is made for these dust formulae that they are as effective as wet sprays when the latter are satisfactorily applied, but they certainly have their place in many instances where the grower is not prepared to go to the trouble of mixing up and applying the necessary materials per a liquid medium.

The dust formulae which have been found most satisfactorily to date in Western Australia are given below. Those numbered 2 and 3 are more often used than any of the others. The dusts should only be mixed up shortly before they are to be used. It is as well to wear a mask during the mixing and using of the dusts to prevent inhaling any of the ingredients in injurious amounts. These masks can be obtained from any of the big rubber firms dealing in motor car tyres, etc.

DUSTS FOR MISCELLANEOUS MARKET-GARDEN AND FLOWER-GARDEN CROPS.

1. *Fungicide Only.*

25 per cent. Copper Carbonate (Basic)
75 per cent. Filler

2. *Fungicide Only.*

10 to 15 per cent. Copper Carbonate (Basic)
40 to 35 per cent. Sulphur
50 per cent. Filler

3. *Fungicide and Stomach Poison.*

10 to 15 per cent. Copper Carbonate (Basic)
40 to 35 per cent. Sulphur
25 per cent. Arsenate of Lead (Basic)
25 per cent. Filler

4. *Fungicide and Stomach Poison.*

25 per cent. Copper Carbonate (Basic)
25 per cent. Arsenate of Lead (Basic)
50 per cent. Filler

5. *Fungicide and Contact Insecticide.*

10 per cent. Copper Carbonate (Basic)
35 per cent. Sulphur
5 per cent. Black Leaf 40 or Nicotine Sulphate
50 per cent. Filler

6. *Fungicide, Contact Insecticide, and Stomach Poison.*

10 per cent. Copper Carbonate (Basic)
35 per cent. Sulphur
5 per cent. Black Leaf 40 or Nicotine Sulphate
25 per cent. Arsenate of Lead (Basic)
25 per cent. Filler

7. *Stomach Poison Only.*

50 per cent. Arsenate of Lead (Basic)
50 per cent. Filler

Filler = Lime (Air-slaked and screened), or Kaolin. Lime is more satisfactory with dusts containing Black Leaf 40 or Nicotine Sulphate.

"Flowers of sulphur," and the powdered form of arsenate of lead, should be used wherever sulphur or arsenate of lead, respectively, are indicated in the formulae.

It is important that a genuine basic carbonate of copper, such as "Sickle" brand, be used throughout the above formulae. At the present time, many of the so-called "copper carbonates" are chemically not carbonates of copper at all, but are basic sulphates, oxychlorides, etc., of copper. While many of these are quite satisfactory for pickling wheat grain to prevent "stinking smut" or "bunt," their safety as dusts for plant foliage has yet to be demonstrated.

In connection with the use of the above formulae, the following definitions may be useful.

A *fungicide* is a material for destroying the spores of a fungus, during germination in moisture, on the surface of a plant. Well known fungal diseases of market-garden plants are "Early Blight" of potatoes and tomatoes (*Macrosporium solani*), "Septoria leaf spot" of tomatoes (*Septoria lycopersici*), "Late Blight" of celery (*Septoria apii*), "Downy Mildew" of onions (*Peronospora Schleideni*), and so on.

A *contact insecticide* is a material for killing sucking insects such as aphids, canary flies, red spiders, thrips, etc., by direct contact with their bodies. Such insects cannot be killed by the use of stomach poisons.

A *stomach poison* kills insects of a chewing kind, such as looping caterpillars, grubs of all kinds, cabbage moth, potato moth and so on. The poison is taken into the stomach of the insect during its feeding operations and is then absorbed into the body tissues, bringing about a more or less speedy death. Some of these chewing insects may be killed by the use of contact insecticides, but very few kinds of sucking insects can be killed by the use of stomach poisons.

A satisfactory and serviceable apparatus for the preparation of dust mixtures on the farm may be made by following the directions given below.*

Take a 40-gallon wooden barrel which has been thoroughly cleaned out. Cut an opening 6 by 8 inches in the side for a door, which is to be fixed in position by strap hinges and held closed by a wooden button or other suitable device. The edges of the door should be padded to prevent leakage. In the centre of each end of the barrel fasten a 1¼in. by 1in. bushing. In each bushing screw a piece of 1-inch pipe which is 6 inches in length. These will serve as an axle on which to rotate the barrel. The barrel is then mounted at a convenient height so that it can be rotated by a crank attached to one end of the axle.

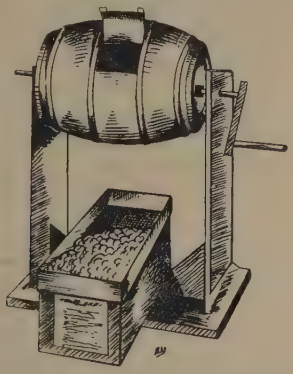


Fig. 1.—Machine for mixing various kinds of fungicidal and insecticidal dusts on the farm.

—*Redrawn after the photograph in Cornell Extension Bulletin No. 206, by C. R. Crosby and Charles Chupp.*

To make the dust, put in the barrel the requisite amount of each of the ingredients which will give a total of 50 pounds of mixed dust. For each pound of the total mixture add about ½ lb. of hard stones or pebbles, from ¾-inch to 1½ inches in diameter, to aid in the mixing. The barrel should then be rotated rather slowly, *i.e.*, thirty-five revolutions per minute, for not less than five minutes by the clock (not by guess). When the mixing is finished, the dust should be dumped out into a box provided with a screened lid to remove the stones. (See Fig. 1.) The dust should be stored in air-tight metal or earthenware containers, and used within as short a period as possible after being prepared.

* The details for the preparation of this home-made mixer have been obtained from Extension Bulletin, 206, "The Control of Diseases and Insects Affecting Vegetable Crops," by C. R. Crosby and Charles Chupp, New York State College of Agriculture, Cornell University, Ithaca, New York, to whom the authors hereby desire to express their thanks.

POULTRY FARMING FOR THE BEGINNER.

Part 4.

G. D. SHAW,
Poultry Adviser, Department of Agriculture.

Poultry farmers must use artificial incubation as a means of renewing the wastage and increasing the numbers of the flock under their control. The natural means of incubation come at a period which is not satisfactory to the rearing of young stock for commercial purposes. Artificial methods of hatching give the poultry farmer a choice of the day of production and in the number of chicks desired.

Hen eggs require 21 days to incubate, no matter whether natural or artificial means are used. A fresh set egg will hatch a few hours earlier than one which is fourteen days old when placed in the machine. Experiments have shown that fertile eggs may be produced within 72 hours after mating, but it is not advisable to set eggs until the birds have been together 14 days—this assures the farmer of reasonable fertility.

VITALITY.

All hatching results depend primarily on the vitality of the germ in the egg, but the efficient operation of the incubator is necessary in order to develop a strong germ into a strong chick. Many factors are the cause of poor hatches and there is little difference between the results of natural, compared with artificial incubation, using eggs from the same pens of birds.

The strong germs spring from strong stock—one can understand how necessary it is to breed from the progeny of successive generations of vigorous well bred birds. Vitality does not exist in mongrel-bred stock- stock that has been inbred for generations and badly fed, and confined in unhealthy conditions.

It cannot be too strongly advocated that all future breeders must be reared in open conditions with plenty of good body-building food. Strong healthy hens mated to strong vigorous mates will produce eggs of strong vitality from which a large percentage of strong healthy chicks will be hatched. Do not conflict the terms fertility and vitality. A fertile egg is the product of the mating, and there is no relation between the "fertility" and the "vitality." Eggs may be fertile but never hatch. They lack vitality; but fertile eggs that have vitality will hatch strong healthy chicks.

Collect eggs as often as possible and stack them on trays or in cases with the big end inclined at 45deg. The temperature of the room should be fairly constant and not more than 70deg. and not less than 55deg. These two extremes keep the germ latent. The room, although sweet, must not be subject to draughts which will cause excessive evaporation of the moisture from the egg and thereby weaken the germ.

SELECTION.

When selecting eggs for hatching take care that the one aim is that the progeny of those eggs when hatched shall have such desirable traits as layers of eggs of even shape, colour, and texture. Bearing these things in mind, one should not

select eggs for incubation unless they have those attributes. Discard any which are uneven in shape, whose colour is not of the desired tint and the texture weak. Like always tends to breed like, more especially in eggs.

Our object should be to ensure that succeeding generations are assisting to attain our ideal, whether in type of bird or colour of egg, and in order to succeed only eggs from birds which are helping towards that object should be selected. Select only strong textured, even coloured, and neatly shaped eggs.

Remember that light-coloured eggs hatch earlier than dark-tinted eggs. It may be possible to hatch those two colours in separate machines. It is not often realised that the dark egg requires a little more heat than the light-coloured egg, so endeavour to even up the temperature to average the hatch.

Select only clean eggs; any that are stained may be gently cleaned. Never place dirt inside an incubator; there is enough trouble without helping it along.

INCUBATORS.

An incubator is an apparatus by means of which eggs may be artificially kept at the proper temperatures, humidity and ventilation for hatching. There have been many different styles and sizes invented to cope with the growing demand of the industry.

For the purpose of this article, it is proposed to deal only with the smaller machines, those designed for the use of poultry farmers who desire to hatch only their own requirements. They may be obtained in sizes from 60-egg to 1,000-egg machines.

The common means of applying heat is by means of kerosene lamps to a hot water supply or to a hot air circulation system. The essential parts of an incubator are the heating apparatus, which is controlled by a regulator, an egg chamber and means of ventilation.

In hot air machines the heat is distributed by means of the hot air being circulated throughout the chamber. In hot water machines the means of distribution is radiation.

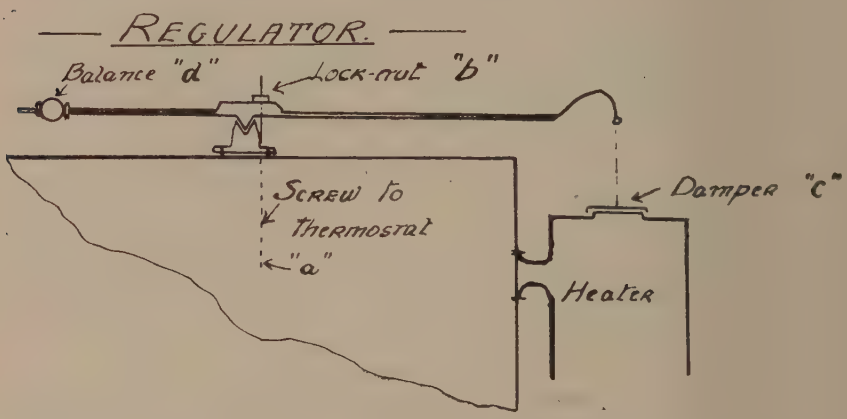
The most common machine is the hot air machine—the air being heated by a kerosene lamp. In these machines the air is introduced into the egg chamber and the eggs are thus surrounded by air at the required temperature. The more evenly the egg chamber is heated the better the results, and to this end action must be taken before eggs are set to ascertain that all parts of the egg tray are heated to an even temperature. To do this it is necessary to first test the thermometers with a control. This is done by placing the control in a basin of water and adding hot water until 103deg. is attained. Immerse the other thermometers and compare the readings. When all thermometers are adjusted insert into incubator at all corners of tray and check readings. (All bulbs should be of even height from bottom of tray (approx. 1¾in.). A variation of ½deg. is of no moment but 1deg. or more should condemn the machine.

The next procedure is to regulate the temperature of the machine to run consistently at 103deg. before admitting the tray of eggs. The thermostat is located inside the chamber. It should not need interference.

A small screwed rod (a) projects upwards and through the top of the machine connecting with the regulator. Before starting to adjust the regulator see that the weight (d) is in such a position that when no strain is applied by the thermostat and rod (a) the damper is lightly closed. By operating the lock nut (b) the damper (c) is made to lift or lower as desired until the heat controlled allows of the hatching chamber being constantly at the desired temperature.

When running, the damper should be "floating" about one-eighth of an inch above the heater. This allows of flexibility of control.

There is a marked corelation between the size of the lamp flame and the floating position of the damper, and one should aim at the fine adjustment which, while not jeopardising heat, should conserve the fuel.



INCUBATOR ROOM.

It is of little use having perfect machines if one operates them in imperfect rooms.

An incubator room need not be of elaborate design, but it certainly must embody plenty of fresh pure air—even temperature day and night (not unduly influenced by climatic conditions), and space enough to operate the machines with comfort.

The egg needs large quantities of fresh air; any restriction will cause a weakened germ with the resultant weakly chick. The more eggs contained in the machine the greater the supply of oxygen required, so see that the room will allow of plenty of ventilation—good air in and bad air out.

Any sudden rise or fall in outside temperatures should not have too marked effect on the inside temperature of the room. Drastic variations are due to badly insulated rooms. When building see that the room is lined, and make due allowance for ventilation. Do not restrict space where incubators are concerned. Ease in adjustment, filling and cleaning are just as important as fresh air. All these factors assist in the efficiency of a hatching season.

The three main artificial properties required for incubation are heat, moisture, and ventilation.

HEAT.

Heat must be uniformly applied to every egg in the machine. It should be consistent in temperature, due allowance being made in the regulator adjustments in order to compensate for outside fluctuations in temperature.

While desiring an even heat of 103deg. over a period of 21 days, the operator may by experience find it necessary to make modifications. Generally, for the first week keep the temperature at 102½deg., 103deg. second week, and it may rise to

103½deg. during the third week. No set rule can be applied. Different incubators need modified applications of the general principles.

Scientific experiments have proved that slight departures from the general principles will not damage the hatch.

MOISTURE.

The egg contains sufficient moisture to efficiently hatch the chick, but our methods tend to withdraw the moisture from the egg. It is therefore necessary to overcome that deficiency by applying moisture to the machine. During incubation some moisture in the egg is evaporated and some absorbed by the growing embryo.

VENTILATION.

Moisture is largely controlled by the rate of ventilation. Too excessive ventilation causes excessive withdrawal of moisture. Too little ventilation causes an accumulation of foul air. We must therefore be sure that while the ventilation is sufficient to keep the air pure it is not so fast as to withdraw excessive moisture.

Moisture and ventilation are closely related. Moisture can be added to the air by the addition of water trays inside the egg chamber, but again one must be careful in not making the air too moisture laden.

The fine adjustments of heat (which also causes evaporation), ventilation and moisture are absolutely necessary for a good hatch.

OPERATING THE INCUBATOR.

The machine must be level in all directions or the heat will be uneven.

The lamp must be filled each day and the wick trimmed. Use only the best of oil and always trim the lamp after handling the eggs; kerosene is fatal to the embryo.

The wick is trimmed by rubbing with the finger and pressing down the corners. Obtain a flame which when extended shows an even height with corners rounded. Take no chances on this, perseverance is essential for this operation. An uneven flame is the cause of trouble which comes at the most unexpected times. Keep the heater clean. Proper wick trimming is the best preventive of smoke and soot.

Gradually heat up the egg chamber—by trying to rush this process one causes smoking of the lamp, and this needs cleaning again thoroughly before one can operate successfully. A soot-covered heater is a source of lost heat.

When filling the trays place the eggs in rows irregularly spaced, big end uppermost, inclined at 45deg. This allows of a full machine after the "clear" eggs are tested out at the four to seven days, when the eggs left should rest on their sides.

The placing of the cool eggs inside the chamber will cause a cooling effect. Allow from 12 to 36 hours to raise the temperature to normal. This slow heating of the eggs is an advantage. Speedy raising to 103deg. has a detrimental effect on the embryo.

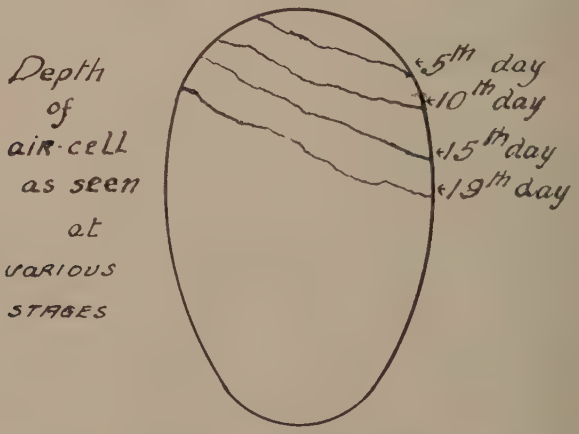
Keep the temperature uniform at all times, and the eggs should begin to hatch about the beginning of the 20th day, the hatch being completed by the evening of the 21st day. Should the hatch be earlier, too great a temperature has been applied, and should the hatch take longer than 21 days, the temperature has been too low.

Do not disturb the eggs for three days, after which they should be turned and cooled twice daily until the evening of the 18th day, after which they are left alone until the hatch is completed. In turning, take care that the position of all the eggs is changed. This should be accomplished without jarring. Remove the tray

from the incubator and place it on a bench which will not allow a draught to come through the eggs. Remove a row of eggs and turn the remainder with the palm of the hand. This turning shifts the position of the embryo so that it cannot adhere to the inner membrane of the shell; any that adhere will die. When turning, change the position of the eggs on the tray; replace the row and then return the tray to the machine.

The cooling is accomplished during the turning process, but as the chick develops, longer cooling is necessary. No set time can be stated, but a good guide is the back of the hand. Disregard the outside temperature, but cool sufficiently that the eggs give off a slight warmth when the back of the hand is applied. At times even one hour is required. This cooling "dries down" the air cell, and it is this drying down of the air cell which gives the operator an idea as to how his machine is operating.

When turning and cooling keep the doors of the incubator closed. On replacing the eggs the temperature of the chamber is lowered. This will right itself without any alteration to the flame or regulator. Test the eggs at the fifth or seventh day for fertility. An infertile egg will show clear.



Shade a lamp by means of a piece of cardboard in which an egg-shaped hole has been cut. By placing the egg over this hole one can see the "clear" egg and the fertile one that contains a spidery-shaped formation which has a dark spot in the centre of the spider.

Dead germs show in several ways. Those which have not been turned properly show as a dark spot on the inside of the shell, others show as circles of blood on the shell. Addled eggs show irregular shapes of shadow formations.

The living germ will always show a colour which is definitely impregnated with deep red. As the embryo develops, the air cell increases until it has assumed a size of nearly one-third of the egg. This is about the 18th or 19th day.

Such increases in size of the air cells are a most important phase of incubation. It is the gauge to ventilation and moisture. Should it not develop one must increase ventilation. Too great a development is overcome by decreased ventilation or added moisture.

The normal place for the air cell is in the large end, but it may appear in other positions.

A second testing is advisable between the 14th and 18th days; one then removes all dead embryo. The remaining eggs are left to hatch. More frequent testings may be made, as it is detrimental to have dead germs in the incubator. The pure air only is wanted.

Towards the completion of the hatching period the animal heat generated by the living embryo will cause an appreciable rise in the temperature in the egg chamber. While instruction books suggest no re-adjustment, it is advisable to keep lifting the damper as occasion demands. When resetting take care to re-adjust the regulator.

Close the machine on the evening of the 18th day and do not interfere with the hatch until the end of the 21st day. All chicks not hatched should not be helped in any way. They will usually be a loss and the first loss is preferable.

At the end of the 21st day remove the tray and leave all hatched chicks inside the machine until they are fully fluffed out. Gradually reduce the internal heat, particularly if there is any sign of panting in the hatching chamber. See that the air is sweet, and when desired, remove chicks to a brooder, taking care that they suffer no chill during the process.

Clean the machine thoroughly with disinfectants before resetting further eggs.

Causes of failure will be dealt with in a later issue.

THE PERPETUAL EXECUTORS' EXPORT PIG TROPHY, 1934.

G. K. Baron-Hay,

Superintendent of Dairying.

Through the generosity of a donor who desired to be anonymous, the Perpetual Trustee Executor Company was able to offer £100 to the Royal Agricultural Society to be used for trophies in connection with consignments of pigs suitable for the export trade in pork and bacon.

The competition was controlled by an executive committee consisting of Messrs. A. J. Monger, E. T. Loton, H. M. Fisher, H. Gillam, W. G. Burges, H. Watson, and G. K. Baron-Hay.

The rules of the competition required that exhibitors should forward 5 pigs in each entry, which should be slaughtered in a metropolitan abattoir. The carcases would then be judged by two local judges and subsequently forwarded to Great Britain for further judgment by British curers. An excellent response to the competition was received, there being 18 entries in the bacon section and 12 in the porker section.

Although no restriction was made with reference to the weights of pigs entered for the competition, exhibitors were advised that the desirable weights were 120 to 160 lb. for bacon carcases and from 60 to 90 lb. dressed weight for porker carcases.

The particular aim of the competition was to obtain information regarding the type of carcase best suited to the British trade, and how such a carcase could be produced profitably under West Australian farming conditions.

The carcases were forwarded to Messrs. Sheed, Thomson & Co. Ltd., London, who arranged for them to be judged by recognised authorities in the pork and bacon trade.

A very full report on 45 porker carcases which were forwarded to London has been received, the judges being Messrs. Jos. B. Swain, Empire Pork House, Smithfield; Dr. John Hammond, F.R.S., Chief of the Physiological Section, Cambridge University; and Mr. H. R. Davidson, M.A., Diploma of Agriculture.

Each carcase was judged individually under the three following sections:—

Section 1—Marketing Points.—Maximum 15.

A. *Skin*—thickness of rind, etc. .. .. .. 5 points.
B. *Colour*—free from bruises and scratches .. 5 points.
C. *Dressing*—proper dehairing and cleanliness .. 5 points.

Section 2—Marks by Inspection.—Maximum 27.

D. *Hams*—external shape .. .. 8 points.
E. *Streak*—thickness and composition .. .. 12 points.
F. *Shoulders*—heavy or fine taper .. .. 7 points.

Section 3—Marks by Measurement.—Maximum 73.

G. Thickness or fullness of *"eye" of loin* .. 28 points.
H. *Fat*—thickness over loin .. .. .. 20 points.
I. *Length of Back* (short loin) .. .. .. 20 points.
J. *Leg*—length .. .. 5 points.

Total Maximum Points—115.

A careful analysis of the very comprehensive report was made and the exhibits grouped according to the breeds submitted by competitors, with the view of ascertaining the average points gained by each group. The points allotted to the various breed-groups in each of the three sections under which the carcases were judged in Britain are shown below in Tables Nos. 1 to 3.

TABLE 1.

Points gained for Marketing Condition (Section 1) according to breed-class. Maximum 15.

Berkshire x Tamworth-Berkshire	9.7
Tamworth x Berkshire	10.8
Large White x Berkshire	12.8
Large White x Middle White	13.6
Large White x Large Black	8.25

Table 1, which shows the average points gained by each breed-group in Section 1 (marketing points), indicates that a white carcase is preferred by the trade for porkers. In this section the white exhibits gained a distinct lead over those submitted by exhibitors of Tamworth x Berkshire. This lead amounted to as much as 2.8 points between the Large White x Middle White over the Tamworth x Berkshire. The Large Black breed crossed with the Large White apparently did not present a desirable appearance.

It is believed that the disability as far as the Tamworth crossed with the Berkshire carcases are concerned in this section can be overcome by careful slaughtering conditions, as the four best carcases of the Tamworth-Berkshire breed averaged 12½ points in this section, which is only 1.5 points behind the Large White crossed with Middle White and only 0.3 points behind the Large White x Berkshire carcases.

It also must be borne in mind that, whereas the points shown for the Tamworth and Berkshire breeds are those for 27 carcases, those for the Large White x Middle White are for only 7 carcases, and for the Large White x Berkshire only 4 carcases.

Table 2 below shows the points gained by each breed-class in the second section, namely, points by inspection:—

Table 2.

Points gained on Inspection (Section 2) according to breed-class. Maximum 27.

	Hams. 8 pts.	Streak. 12 pts.	Shoulder. 7 pts.	Total. Section 2.
Berkshire x Tamworth Berkshire ..	6.2	6.9	5.1	18.2
Tamworth x Berkshire	6.1	7.2	5.4	18.7
Large White x Berkshire	6.7	6.5	4.7	18.0
Large White x Middle White	6.0	6.6	5.4	18.0
Large White x Large Black	4.5	6.75	5.0	16.2

It will be seen from this table that the carcases in Section 2 were judged according to the conformation of the hams, the presence and condition of the streak of lean and fat, and the fineness of shoulder.

D. *Hams—Maximum* 8 *points.*

In this section the Tamworth-Berkshire cross is seen to a slight advantage over the Large White x Middle White, although the 4 carcases consisting of Large White x Berkshire breeds showed a lead of 0.5 points, as the external shape of the ham was considered more desirable. Here again, the large number of Tamworth-Berkshire crosses in comparison with the other breeds must be borne in mind.

Only 4 carcases gained full points, three of these being carcases of the Berkshire crossed with Tamworth-Berkshire, one being a Large White x Berkshire, the Berkshire breed apparently giving the shape to the ham, which is lacking in the pure Large White and Tamworth breeds.

E. *Streak—Maximum* 12 *points.*

The Tamworth-Berkshire and Berkshire x Tamworth-Berkshire carcases easily lead in this section, the desirable type of streak undoubtedly being due to the inclusion of the Tamworth breed. Owing to the lowness of the points, however, there is considerable room for improvement in this section, and it is believed this can be remedied by strict attention to feeding.

F. *Shoulders—Maximum* 7 *points.*

In this section the Tamworth x Berkshire carcases scored on the average the same points as the Large White x Middle White carcases. It is recognised that the Middle White and the Berkshire breeds are very similar in conformation, and, therefore, from this it may be inferred that the Tamworth and the Large White have a similar influence on the conformation of the pork and bacon pig.

In the fourth column of Table 2 it will be seen that the Tamworth x Berkshire carcases have the highest total points.

Table 3 below gives the marks obtained in Section 3 by actual measurement in the breed classes.

Table 3.

Points gained by Actual Measurement (Section 3) according to breed-class. Maximum 73.

	"Eye." 28 pts.	Fat. 20 pts.	Length of back 20 pts.	Length of leg 5 pts.	Total Section 3.
Berkshire x Tamworth-Berkshire	16.9	16.0	8.7	4.2	45.8
Tamworth x Berkshire	14.2	14.2	9.8	3.3	41.5
Large White x Berkshire ..	13.2	12.5	6.7	4.0	36.4
Large White x Middle White ..	11.1	12.6	7.7	3.3	34.7
Large White x Large Black ..	12.2	12.2	9.5	1.5	35.4

G. *"Eye" of Loin—Maximum 28 points.*

In this class the Tamworth and Berkshire crosses were undoubtedly superior to the other breed types which were represented in the competition, and this superiority would be more marked if the number of carcases in each case were equal. The seven best Tamworth-Berkshire crosses scored an average of no less than 19.4 points, one carcase composed of the Berkshire crossed with Tamworth-Berkshire scoring as much as 24 points in this section.

H. *Thickness of Fat—Maximum 20 points.*

In this section also it will be noticed that the Berkshire crossed with the Tamworth-Berkshire, and the Tamworth crossed with Berkshire carcases have a very definite lead over other breeds. This is directly due to the influence of the Tamworth breed, but speaks well for the type of Berkshire pig owned by the winning exhibitor, Mr. C. H. Overheu, as, with two crosses of Berkshire, his exhibit gained the highest points for thickness of fat. It may be mentioned that the Berkshire boar in use is of English blood.

I. *Length of Back—Maximum 20 points.*

In this section it will be seen that the Tamworth crossed with the Berkshire has gained a lead of 2.1 points over the Large White crossed with the Middle White, although, as might be expected, the Large White crossed with the Large Black has scored well for length of back. This cross, however, is not to be recommended, as in no other section has it shown to advantage.

J. *Length of Leg—Maximum 5 points.*

As would be expected, crosses showing the Berkshire breed exhibit a shorter leg or shank than other crosses, the Tamworth-Berkshire in this section being equal to the Large White crossed with the Middle White, again confirming the belief that the Tamworth and the Large White exhibit a very similar influence on the conformation of carcases.

In the final column of Table 3 above, it will be obvious that it is in the points judged by actual measurement that the Tamworth and Berkshire crosses have excelled.

A close inspection of Tables 2 and 3 also shows that it is extremely dangerous to rely entirely on inspection of a carcase without actual measurement in attempting to arrive at a decision on its relative merit, and the difficulty is more accentuated when attempting to judge the suitability of a pig for pork or bacon while on the hoof.

In Table 4 the total points obtained by each breed class is shown, in which again the Tamworth and Berkshire crosses lead.

TABLE 4.

Average Total Points in each Breed-class.

Breed.	No. of carcases.	Average points.	Points for best five carcases.
1. Berkshire x Tamworth-Berkshire ..	10	73.8	77.2
2. Tamworth x Berkshire	17	71.1	80.2
3. 1 and 2 combined	27	72.1	82.2
4. Large White x Middle White ..	7	66.3	70.6
5. Large White x Berkshire	4	67.25	—
6. Large White x Large Black	4	60.0	—
7. Unknown breeding	2	56.0	—
8. Duroc-Jersey	1	42.0	—

The following remarks were made by the judges on the general quality of the 45 porker carcases received:—

"It will be noticed that most of the pigs scored well in Section 1—Marketing Points.

"In Section 2—Marks by Inspection—attention is called to the low scoring in 'E' ('Streak'), and that, owing to a stretcher being used while freezing the carcases, the bellies become folded or crinkled just at the place where they are cross sectioned for examination, which resulted in great difficulty in correct marking. The trade in this country does not require such a stretcher, it being much better to let the carcase and belly hang free.

In Section 3—Marks by Measurement—good marks were earned for 'eye' of loin, although under 'I' (length of loin), the carcases did not show to such advantage, as the bodies were comparatively short. This is a matter which should receive attention.

"In the opinion of all who saw them, they were the best lot of pigs yet seen from Western Australia."

Owing to a series of unfortunate occurrences in Britain, no detailed examination of the bacon carcases were made. The following general report, however, was forwarded by Messrs. Sheed Thomson & Co. Ltd., London, regarding the consignment of bacon pigs:—

"The shape of the pigs generally was satisfactory, except that in some of them the shoulders were too large in proportion to the rest of the sides. The pigs up to 140 lb. were quite satisfactory as to fat, but some of those over 140 lb. were on the fat side, although on the whole there is nothing unfavourable to report in that direction."

This report confirms the recommendation which has been made by the Department of Agriculture since the conference in February, 1930, with manufacturers and leading breeders, namely, that the requirements of the British market can be met by suitable crossings of the Tamworth and Berkshire breeds, which breeds have proved suitable to the climatice conditions in Western Australia.

Further confirmation also was provided by experiments conducted over two years with the Tamworth, Berkshire and Large White breeds by courtesy of Mr. W. G. Burges, "Tipperary," York. In these experiments, all pigs were run under similar conditions and, after being weighed monthly, were slaughtered, the carcases being forwarded to Britain for examination. The result of these reports also showed that, by careful attention to feeding and the selection of a lengthy Berkshire sow, preferably of the "Canadian" type, excellent carcases of both pork and bacon suitable for the British market could be produced, by crossing the Tamworth and Berkshire breeds.

THE COMMON THORNAPPLE

(*Datura Stramonium*, Linn.)

AND RELATED SPECIES OCCURRING IN WESTERN AUSTRALIA.

C. A. GARDNER,
Government Botanist.

The Common Thornapple (*Datura Stramonium*, Linn.), an annual weed and poison plant has been established in certain districts of Western Australia for many years. It is of summer growth, and is thus limited in distribution to soils which retain some moisture during the vegetative period, as for example, fallowed land, watercourses, depressions or other alluvial summer moist spots. One of its most objectionable features as a weed lies in the longevity of its seeds which are produced abundantly in the Horse-chestnut-like capsules formed during the autumn. These seeds are scattered by the dehiscence of the capsule, and may remain in a viable condition in the soil for some years before germinating.

The origin of the plant's introduction into Western Australia is unknown, but it probably arrived here in seeds or packing from abroad. It has certainly been established locally for a long time, and introductions of the seeds are still continued in packing and with other seeds, *e.g.*, Sudan grass and seed wheat from other States. Thornapple is common on waste land around Perth, and in many centres in the agricultural areas, and the seeds are spread from the infected areas principally by the agency of flood waters and transferred soil.

Although the weed is now almost cosmopolitan in distribution, being found in every country except the arctic regions, there appears to be some doubt regarding its original home. This has been given as India, North America, and South America, but De Candolle is probably correct in his statement that the species is native to the region of the Caspian Sea. Gypsies are said to have aided in spreading the plant into Europe, since it is probable that they had some knowledge of its uses.

The name Datura is from the Hindoo *Dhatura*, derived from the Sanskrit *D'hustura*, applied to the Indian species *D. fastuosa*, well known to the mediaeval Arabian physicians under the name of Tatorea and Mathil, while the Persians knew it under the name of Tatulah. These names appear to have some connection with the specific names Tatula and Metel. The specific name Stramonium is of uncertain origin, but probably is derived from the Greek name of the mad-apple.

The uses of the plant have been recognised since early times, and it is supposed that the priests of Apollo at Delphi used the leaves to assist them in their prophecies. Sanskrit writers, according to Dymock, describe Datura as being beneficial in mental derangements, fever with catarrhal and cerebral complications, diarrhoea, skin diseases associated with the presence of animal parasites, painful tumours, inflammation of the breasts, etc. A pill made from the pounded seeds was placed in decayed teeth to relieve toothache and the leaves are smoked together with tobacco in asthma. The Persians used *D. Tatula* ("Tatulah") as a local application for the relief of tumours and piles, while the roasted leaves applied to the eyes give relief in ophthalmia. The Arabs of Central Africa are stated to use the dried leaves, flowers, and bark of the roots when smoked as a relief from asthma and influenza. In India the seeds are used for their intoxicating and stupefying effects in the composition of alcoholic beverages which render the consumers, literally, mad. The seeds are used not only for the purposes of murder, but also for stupefying victims with a view to robbery. The Peruvians prepare a similar intoxicating beverage from the seeds which produces stupefaction and delirium.

Thornapple is included in most pharmacopoeias, but has been omitted from the latest British list. It is cultivated in America for its leaves which are widely used in medicine. These contain the alkaloids *hyoscyamine, atropine* and *hyoscine,* principally in the midrib and footstalk of the leaf. The leaves are also rich in potassium nitrate.

PLATE I.

Datura Stramonium, Linn.

A, Habit, showing leaves, flowers and fruit. B, Longitudinal section of immature fruit. C, Ripe dehiscing capsule. D, Section of capsule, showing the four cells. E, Seeds.

The properties of the drug are those of hyoscyamine, which acts similarly to belladonna, and is used for the same purposes, but is considered to be slightly more sedative to the central nervous system, and less constipating than belladonna. Stramonium cigarettes used for asthma are made from the leaves, but the treat-

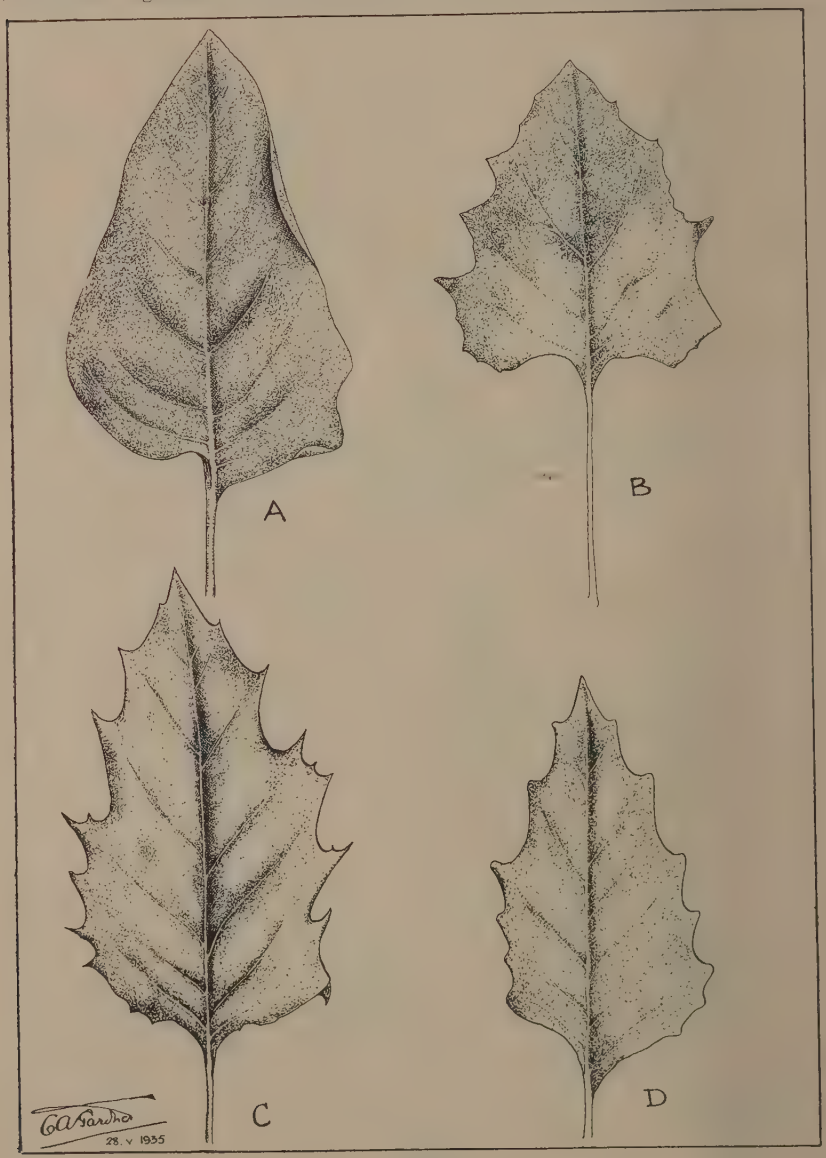


PLATE II.

Leaves.

A, Datura Metel. B, D. ferox. C, D. Stramonium. D, D. Leichhardtii.
All about half natural size.

ment is palliative only. Other preparations are also in use, such as an ointment for muscular rheumatism and haemorrhoids.

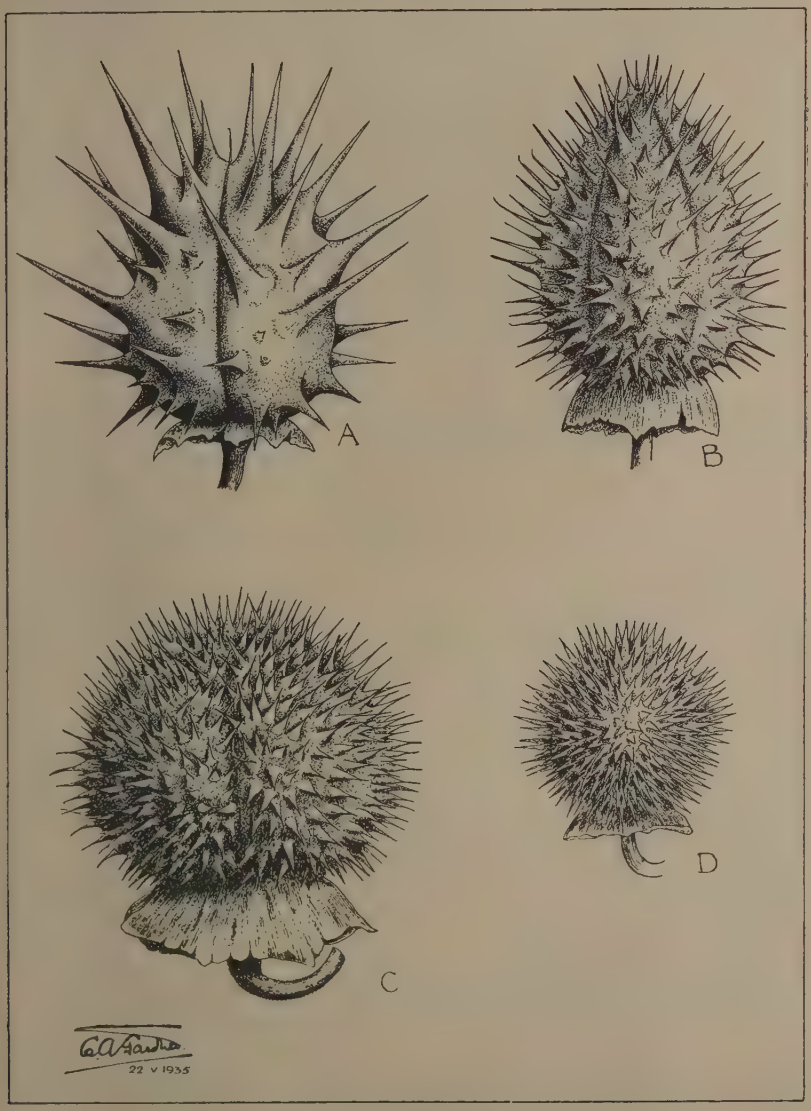


PLATE III.
Fruits.
A, Datura ferox. B, D. Stramonium. C, D. Metel. D, D. Leichhardtii.
All about two-thirds natural size. (C and D inverted; they are normally deflexed.)

All parts of the plant are poisonous, but the seeds are the most active, and neither drying nor boiling destroys the poisonous properties. Symptoms of poisoning include paralysis, dilation of the pupils, suspension of secretion and of the inhibitory fibres of the vagus, leading to rapid action of the heart, dimness of

sight, giddiness and delirium, which sometimes amounts to mania. Death may follow. Cattle are as susceptible as horses, but the herbivora are not so easily influenced as the carnivora. The dominant action of atropine and hyoscyamine is to depress the activity of the nerve endings, and thus they prevent the proper functioning of tissues and organs under their control. Thus the salivary and sweat glands are paralysed, causing dryness of the mouth, throat and skin, while the nerves which normally function in slowing down the pulse are affected, causing an acceleration of the heart. The muscular coats of the bronchial tubes are relaxed owing to this paralysis of the nerve ends, hence the value of the drug in the treatment of asthma. The action on the brain centres results in these being excited, causing prolonged delirium, while those centres controlling the blood pressure, pulse and respiration are also affected. Death is usually due to heart-failure combined with asphyxia due to depression of respiration.

Browsing animals rarely eat the plant because of its disagreeable odour and nauseous taste, while the seeds are protected from being eaten by their inclusion in spiny fruits. There is, however, a grave risk of poisoning by the dry plant being incorporated in hay or ensilage, and losses in stock from hay and chaff are numerous.

The plant is an annual of summer growth, and its control consists essentially in the prevention of the formation of seeds. This is best accomplished by pulling up or hoeing out the plants before, or not later than the flowering stage. Under no circumstances should the plants be allowed to seed. The weed is most frequent in fallowed land and situations moist in summer, and a careful watch should be kept in such places when the existence of the plant is suspected.

The genus Datura can be readily distinguished from other Solanaceous plants by the inflated 5-toothed calyx which, in the case of those species which are weeds separates about the middle, the lower portion broadening and reflexing under the fruit, the trumpet-shaped corolla which is folded in the bud, and usually white in colour, the five enclosed stamens, and the four-valved capsule armed with spines.

In addition to the Common Thornapple, there are five other species occurring in Western Australia, of which number, one is native (*D. Leichhardtii*), one a small tree common in gardens, and three are introduced weeds. The species in cultivation is commonly known as the "Trumpet-flowered tree," a plant of from six to twelve feet in height with large velvety leaves and long pendulous white, sweetly scented flowers. These flowers in the local examples are "double" and do not produce seeds. Its botanical name is *D. suaveolens*.

The following key gives the principal distinctions between the six species occurring in Western Australia. This key should be used in conjunction with the accompanying plates:—

KEY TO THE LOCAL SPECIES.

A. Calyx circumcissile, the upper portion falling off entire, the basal part reflexed, and persistent under the fruit. Weeds.
  a. Capsule erect, ovate; seeds black when mature.
    α. Leaves ovate-rhomboidal, angular-toothed; fruit armed with long stout spines .. .. 1. D. ferox.
    β. Leaves ovate-acuminate, unequally sinuately lobed or toothed; fruit almost equally spinous, the spines rather slender.
      I. Flowers white; stems green .. .. .. 2. D. Stramonium.
      II. Flowers blue or pale violet; stems purplish .. 3. D. Tatula.
  b. Capsule deflexed, globular; seeds pale or brown.
    α. Flowers large, 10-15 cm. long, white or purple; capsule 4 cm. diameter; leaves more or less entire .. 4. D. Metel.
    . Flowers small, white, 5 cm. long; leaves sinuately toothed .. .. 5. D. Leichhardtii.
B. Calyx not circumcissile; flowers 20-30 cm. long, pendulous; small tree. Cultivated plant .. .. 6. D. suaveolens.

Datura ferox, native to China, occurs around Coolgardie and Kalgoorlie, and is also recorded from York. The flowers are white or bluish. It is an annual.

Datura Stramonium is to be found scattered over a large area in the South-West and wheat areas, extending also to the Eastern and Northern Goldfields.

Datura Tatula has been received from numerous localities. It apparently occurs in the same places as D. Stramonium, from which it only differs in the colour of the flowers and stems.

D. Metel is recorded from Leonora, Coolgardie, Kalgoorlie, Northam and Cannington. It has long white or pale violet flowers, and is native to tropical America.

Datura Leichhardtii is the sole species indigenous to Australia. In Western Australia it is recorded from the Ashburton River and parts of the Gascoyne River. It is not known to occur further South than Carnarvon.

Datura suaveolens, known to some horticulturists as Brunsfelsia, but incorrectly so, is limited to gardens, and not being locally distributed by seeds, has not escaped from cultivation.

The species D. ferox, D. Stramonium, D. Tatula and D. Metel are proclaimed Noxious Weeds for the State of Western Australia. All share the general characteristics of the Common Thornapple and are similarly poisonous, and must be immediately eradicated wherever seen.

SOME FURTHER RETURNS AND MARKETING COSTS OF EXPORT LAMBS FROM THE AVONDALE EXPERIMENT FARM.

N. Davenport, B.Sc. Agric.,
Senior Agricultural Adviser.

With our marketing in the vicinity of 140,000 lambs at Smithfield during the past season, the production of export lambs has now become an important phase in the agriculture of this State. At a time when our surplus sheep problem was becoming very acute due to the low prices ruling on an overloaded local market the campaign was commenced to market as much of our surplus as possible overseas in the form of frozen lamb. By sharing in the London trade the possibility of a glut on our local markets has thus been avoided, a satisfactory local price level has been maintained and the total return to the industry considerably increased.

The Smithfield market is a keen one and it has repeatedly been borne home to us that we must conform to its demands as closely as possible and show no neglect in detail.

From the results of experiments conducted at the Avondale Experiment Farm, at Beverley, and by Mr. W. G. Burges of "Tipperary," York, together with advice from selling brokers and meat experts of London and also from our own experience the most suitable breeding for the export lamb has been determined. Such a lamb is produced by mating a British long-wool-merino cross ewe with a Southdown ram. Lambs of this breeding (Southdown ram x Border Leicester-merino ewe) are being produced at the Avondale Experiment Farm, and for each of the last two years we have forwarded 376 to the

W.A. Meat Export Co's. works at Robb's Jetty for treatment for export. From the returns received, data in connection with the marketing has been obtained which will no doubt be of interest to those engaged in the fat lamb industry.

PARTICULARS OF CONSIGNMENTS.

Shipments were forwarded throughout the seasons of 1933 and 1934 and the following table gives the details of each consignment with respect to the grading of the carcases and the period of marketing.

TABLE 1.

Year.	Date Slaughtered.	Total Slaughtered.	Grading of Carcases.					No. Shipped	Date Shipped.	Vessel.
			Swandown, Choice Grade.	Blue-Gum, 1st Grade.	Red Gum, 2nd Grade.	* White Gum, 3rd Grade.	Rejects.			
1933	July 19 ...	82	41	9	19	13	...	69	Aug. 7 ...	Mooltan
	Aug. 3 ...									
	Aug. 16 ...	49	28	7	11	3	...	46	Aug. 21 ...	Chitral
	Aug. 30 ...	111	35	48	23	4	1	106	Sept. 4 ...	Narkunda
	Sept. 12 ...	35	9	13	9	4	...	31	Sept. 18 ...	Strathaird
	Oct. 4 ...	44	15	27	2	...	...	44	Oct. 9 ...	Baradine
	Oct. 17 ...	55	26	19	9	1	...	54	Oct. 23 ...	Hobson's Bay
Total for Year...		376	154	123	73	25	1	350		
1934	Aug. 1 ...	36	6	23	5	1	1	34	Aug. 6 ...	Narkunda
	Aug. 15 ...	77	11	39	18	9	...	68	Aug. 20 ...	Naldera
	Aug. 29 ...	73	20	38	15	...	...	73	Sept. 3 ...	Cathay
	Sept. 25...	95	20	45	28	1	1	93	Oct. 1 ...	Maloja
	Oct. 23 ...	95	66	26	32	...	...	95	Oct. 29 ...	Mooltan
Total for Year...		376	123	171	69	11	2	363		

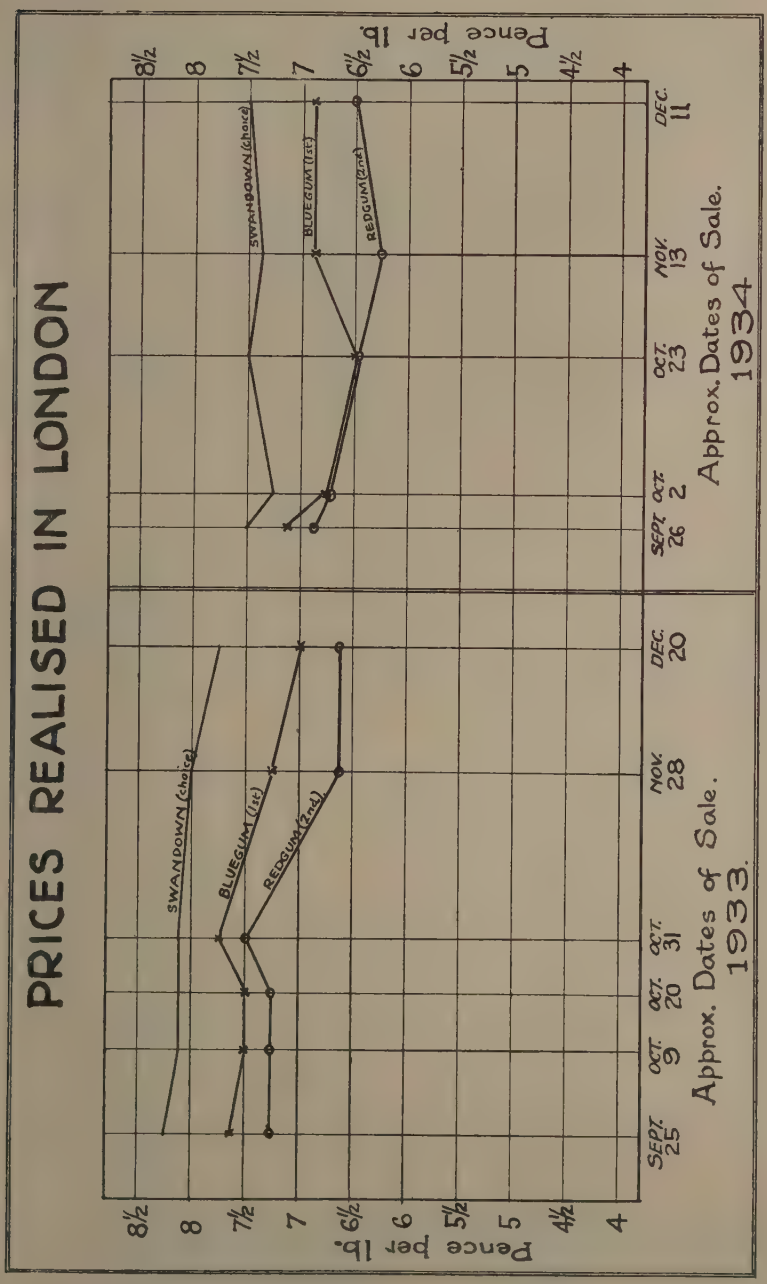
* Not shipped.

In view of the necessity for establishing a name for quality meat, it was not considered advisable to market the poorer quality carcases overseas, and, therefore, those graded as White Gum (3rd Grade), together with those rejected for export, were sold locally. After passing through the grader's hands, the 1st or Blue Gum Grade was further divided and the choice quality lambs were selected to carry the Swandown label indicating a Southdown cross lamb of choice quality. This Swandown grade has met with a very ready sale and has been highly praised by the London experts.

When lambs are being graded, besides being allotted a quality grade such as Blue Gum for 1st Grade, Red Gum for 2nd Grade and White Gum for 3rd Grade, each carcase is also graded according to its weight and is given a distinguishing number on the grading tag indicating its weight grade. The range 28 lb.-36 lb. is known as weight grade "2," the range 37 lb.-42 lb. is known as weight grade "8," and the lambs weighing over 42 lbs. carry the weight grade mark "4." For reasons of space these weight grades as subdivisions of the quality grades are not shown in the above table.

PRICES REALISED IN LONDON.

The following graph shows the prices per pound realised for the carcases sold in 1933 and 1934 for each shipment. Separate price levels are given for the choice, 1st and 2nd quality grades of weight grade "2" (28 lb.-36 lb.) in each case.


PRICES REALISED IN LONDON
Pence per lb.
8½
8
7½
7
6½
6
5½
5
4½
4
SEPT. 25
OCT. 9
OCT. 20
OCT. 31
NOV. 28
DEC. 20
SWANDOWN (choice)
BLUEGUM (1st)
REDGUM (2nd)
Approx. Dates of Sale.
1933.
SEPT. 26
OCT. 2
OCT. 23
NOV. 13
DEC. 11
SWANDOWN (choice)
BLUE GUM (1st)
REDGUM (2nd)
Approx. Dates of Sale.
1934

While there was a slight downward trend for Swandown grade lambs in 1933, this did not occur the following season when the price of this grade varied only ¼d. per lb. for the five shipments extending over 2½ months. For the two-year period the price for Swandown lambs ranged from ¾d. to 1d. per lb. higher than 1st Grade lambs. These, in turn, were quoted from ¼d. to ½d. per lb. higher than those of 2nd Grade with the exception of two shipments in 1934, when 1st and 2nd Grade carcases realised the same price per lb.

When speaking recently at a Jubilee function in London Sir Hal Colebatch (Agent General for Western Australia) stated that at the Smithfield meat market Swandown lambs commanded a better price than those from any other part of Australia.

From the reports of trade experts familiar with West Australian lambs it is confidently believed that the Swandown quality had the effect of raising the general level of lamb prices.

This price graph shows clearly the advantage of having as high a quality level of production as possible. The total return for a lower quality carcase is appreciably less, while the marketing costs are identical per lb. as for one of choice grade.

COST OF MARKETING.

Practically all charges made during the process of marketing frozen lamb are assessed on a weight basis, i.e., charge per lb.

The following statement sets out the average cost per lb. of marketing all lambs last season from the Avondale Experiment Farm, and will serve as a reliable guide to the prospective exporter who wishes to have this information for use in his business calculations:—

	pence per lb.
Local charges, including—	
Killing, freezing, and shipping, at 1d. per lb.	1.02
Drying skins, at 1½d. each	
Cartage of skins, at 3s. 9d. per 100	
And adjustment of credit for caul fat, at 1d. per lb. ..	
Ocean freight—	
At 1¼d. per lb., less 10 per cent., plus 18 per cent. exchange	1.33
London charges—	
Including insurance, port rates, weighing, cold storage, cartage, and commission, and exchange at 25 per cent.	.61
Total	2.96
Less credit for skins	.72
Net cost ex works	2.24

To this total of 2.24 pence, or say 2¼d. per lb., ex works must be added the rail freight from the farm siding. In the case of Beverley this is approximately 1s. per lamb, or .36 pence per lb., and the total cost ex farm is therefore 2.60 pence, or 2 3/5 pence per lb.

In calculating the probable return per lb. on the Smithfield market, an exchange rate of 25 per cent. is added to the London price per lb., and from this is subtracted the charge of 2¼ pence per lb. for marketing. This gives the return per lb. at the works, and from it must be subtracted the rail freight from the farm siding.

AVERAGE NET RETURNS PER LAMB.

In determining the actual net return at Fremantle of the carcases exported, the figures were compiled for each quality grade for each shipment over the two-year period under review.

Local charges and those at London were divided proportionately according to the weight of the respective grades, and the average returns so obtained are listed in the following table. For the net returns at Beverley, 1s. per lamb must be deducted for rail freight.

TABLE 2.

Year.	Shipment.	Approx. Date Sold.	Average Return per Lamb.			
			Swandown.	Blue Gum.	Red Gum.	All Lambs.
			s. d.	s. d.	s. d.	s. d.
1933	Mooltan	Sept. 25 ...	19 3	17 3	16 3	18 2
	Chitral	Oct. 9 ...	19 11	17 0	16 3	18 7
	Narkunda	Oct. 20 ...	19 10	16 8	15 9	17 6
	Strathaird	Oct. 31 ...	18 9	17 5	15 6	17 3
	Baradine	Nov. 28 ...	19 10	17 1	14 1	17 10
	Hobson's Bay	Dec. 20 ...	20 4	16 0	15 1	17 11
	Average for Season ...	... ...	19 9	16 9	15 10	17 10
	Average weights of Lambs	... ...	30·1 lb.	28·3 lb.	27·9 lb.	29·0 lb.
1934	Narkunda	Sept. 26 ...	20 4	17 11	16 5	18 1
	Naldera	Oct. 2 ...	19 9	16 8	16 5	17 1
	Cathay	Oct. 23 ...	21 4	15 3	15 1	16 10
	Maloja	Nov. 13 ...	20 0	18 6	16 1	18 1
	Mooltan	Dec. 11 ...	21 2	19 1	15 6	20 5
	Average for Season ...	... ...	20 10	17 5	15 11	18 3
	Average weights of Lambs	... ...	36·4 lb.	33·5 lb.	32·6 lb.	34·3 lb.

It is significant to note the comparatively large margin of return between Swandown and Bluegum lambs for both years of 3s. and 3s. 5d. respectively. This difference is partly due, of course, to the higher average weight of the Swandown grade, but even when calculated to the equivalent of the weight of the Bluegum lambs, the margins of difference are 1s. 10d. and 1s. 9d. per lamb respectively. Here again is indicated the improved returns which may be obtained by producing as high a proportion as possible of high quality lambs. Although the price levels of 1933 were greater than those of 1934, the net return per lamb was greater for the latter year. This is due to the higher average weight of the lambs in that season.

It might reasonably be assumed then that it would pay to market a comparatively heavy weight lamb while still maintaining its quality.

An examination of the returns from this aspect, however, shows a position rather different, and there is not the gain to be made by adopting this practice, as the results seem to indicate. The heavier lambs suffer a reduction in price

due to their size alone, without regard to quality, as smaller carcases are preferred by the trade, and when the added expense is reckoned with in marketing the extra weight, the actual monetary gain is by no means proportional to the extra weight of the carcase.

Indeed for carcases over 40 lbs. it appears that the net return would probably be less than if they were marketed at a lower weight, that is providing the quality remained constant.

The following table gives some comparative returns of light and heavy weight lambs sold last season.

TABLE 3.

Shipment.	Quality Grade.	Weight Grade.	Average weight.	Net return at Works. s.	d.
Mooltan	Swandown	2	34·9	20	10
		3	39·3	21	5
		4	43·9	21	0
	Bluegum	2	34·6	18	4
		3	39·5	19	6
		4	46·0	19	1
Maloja	Swandown	2	34·2	19	11
		3	39·0	20	0
	Bluegum	2	34·7	18	6
		3	40·7	19	0
Narkunda	Bluegum	2	32·3	17	8
		3	38·0	19	4

From the above two tables it appears then that a lamb should be held not until it reaches a certain weight only, irrespective of quality, but rather that its quality should be the main factor in deciding when to market, giving due consideration to weight when the carcase is judged to fall within the "8" weight grade.

Lambs vary considerably as to their time of reaching marketable size and quality. It is quite possible that a second grade lamb of 30 lbs. may have developed into a first grade lamb, dressing say 36 lbs., while, on the other hand, the conformation of others would always prevent their being graded anything but 2nd grade no matter what the size and age.

Every endeavour should thus be made to provide abundant suitable pasture in order that the lamb should receive ample nourishment without interruption and thus attain its standard of quality as early as possible during its development.

WARNING TO OWNERS OF DAIRY SIRES.

Purchasers of pure-bred sires over the age of 9 months are advised to ascertain at the time of purchase that such animals have been life registered under the "Dairy Cattle Improvement Act Amendment Act, 1932," and to obtain from the vendor the certificate of registration. The transfer of such bull must also be recorded at the Department of Agriculture.

Owners of unregistered grade bulls are warned that steps are now being taken to enforce the provisions of the Act, which require annual registration for a fee of 5s.

PURE BREED HERD RECORDING SCHEME, 1934-35.

G. K. Baron-Hay,
Superintendent of Dairying.

During the period 30th November, 1934, to 15th May, 1935, 180 pure bred cows of the Guernsey, Jersey, and Australian Illawarra shorthorn breeds have completed their test, the record in detail being shown below.

The cows comprised 76 Jerseys, 75 A1 Shorthorns, and 29 Guernseys, the average production of all cows tested being 319.85 lbs. of butter fat.

The average butter fat production for each class in each breed was as follows:—

Breed.	No.	Mature.	No.	Senior (4).	No.	Junior (4).	No.	Senior (3).
		Pounds of Butter Fat.						
Jersey	27	339·89	8	386·06	2	220·33	9	354·86
A.I.S.	32	357·58	7	353·50	4	202·72	4	379·04
Guernsey	7	335·02	5	386·41	1	371·16	...	...

Breed.	No.	Junior (3).	No.	Senior (2).	No.	Junior (2).	No.	Average.
		Pounds of Butter Fat						
Jersey	5	268·05	10	289·46	15	235·74	76	311·46
A.I.S.	6	286·13	6	246·17	16	259·12	75	327·65
Guernsey	5	312·23	...	...	11	283·48	29	321·64

Breeders are to be congratulated on the high average productions of the cows in their herds during the present recording year. No less than 10 cows have exceeded 500 lbs. of butter-fat during their 273-day lactation period, this number being 5.5 per cent. of all cows tested. These cows include 6 of the A1 Shorthorn, 3 of the Jersey, and 1 of the Guernsey breed.

THE OFFICIAL AUSTRALIAN PURE BRED DAIRY CATTLE PRODUCTION RECORDING SCHEME.

Cows which Completed Test 30th November, 1934, to 15th May, 1935.

MATURE COWS (OVER 5 YEARS OLD)—STANDARD 350 LB. BUTTER FAT.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk Last day of Test.	Weight of Milk for period.	Average Test.	Weight of Butter Fat for period.	Owner.	Sire.
						lb.	lb.	%	lb.		
Banyule Silvermine 55th ...	Jersey ...	25473	2-8-28	30-5-34	273	33	11,759	5·76	677·97	Dept. of Agriculture ..	Air Lord of Banyule (3337)
Kurrawong Kitty 8th	A.I.S. ...	16030	6-8-26	1-8-34	273	29·5	13,183	4·28	565·23	W. G. Burges ...	Premier of Kullawong (1212)
Telyarup Duchess	do. ...	2504	9-12-28	10-5-34	273	31·5	15,094	3·73	564·37	A. E. Grant	Baron of Darbalara (2824)
Wooroloo Rose 2nd	do. ...	2523	27-4-29	22-5-34	273	26	12,033	4·50	542·58	Wooroloo Sanitorium	Triumph of Pine Creek (2515)
Tabbagong Dove 4th	do. ...	14725	30-9-26	9-7-34	273	30·5	13,636	3·96	540·09	W. G. Burgess ...	Mayflower Repeater of Hillview (905)
Flash of East View	do. ...	18331	4-10-28	16-4-34	273	25·5	12,871	4·12	531·04	A. E. Grant	Mariner of Greyleigh (587)
Banyule Silvermine 38th ...	Jersey ...	18817	19-10-25	13-5-34	273	25·5	8,320	5·88	489·78	Dept. of Agriculture ..	Wotton Airman (imp.) (2716)
Tabbagong Beauty 11th ...	A.I.S. ...	1683	25-6-28	9-7-34	273	33	10,799	4·46	481·49	P. E. Warburton ...	Daisy's Gift of Hillview (759)
Minathorpe Treasure 3rd ...	do. ...	Vol. VIII	10-7-28	3-5-34	273	32	10,086	4·62	466·63	P. E. Warburton ...	Bruce of Minathorpe
Grassvale Lady Fowler 3rd ...	Jersey ...	19111	20-5-25	25-5-34	273	13	9,039	5·12	462·87	R. H. Rose	Rye Duke of Glen Iris (1994)
Picture 8th of Raleigh ...	A.I.S. ...	17524	22-4-27	20-6-34	273	12·5	11,677	3·84	448·83	D. Bevan	Union Jack of Raleigh (2375)
Brackenhurst Gibson's Melba ...	do. ...	13720	28-9-28	4-3-34	273	35·5	10,277	4·34	446·43	P. E. Warburton ...	Captain 1st of Wongong
Greenmount Charming Lass ...	Jersey ...	20903	3-6-25	1-8-34	273	14·5	7,503	5·8	438·56	A. J. B. Strempel ...	Werribee Starbright's King (2602)
Victress of Toora	A.I.S. ...	17887	7-3-28	8-7-34	273	16·5	9,800	4·33	424·37	A. E. Grant	Victor of Darbalara (2384)
Juadine Daisy 2nd	Jersey ...	34342	24-6-29	20-6-34	273	23	9,324	4·54	423·90	L. Hancock	The Valley Twylish Fox
Karridale Lady Betty ...	Guernsey ..	2331	19-9-28	15-8-34	273	24 5	8,663	4·86	421·11	G. E. Scott	Minnamurra Oliver Twist (528)
Minnamurra Arvieto	do. ...	1597	4-8-26	17-4-34	273	22	8,601	4·86	420·65	A. G. Haynes ...	Minnamurra Golden Lad (402)
Wollongbar Betty 2nd	do. ...	1571	4-7-26	5-7-34	273	25	7,935	5·25	419·06	Muresk Agricultural College	Bounty of Wollongbar (336)
Grass Vale Montrose Maid ...	Jersey ...	24929	18-6-27	1-5-34	273	20	7,995	5·20	416·27	R. H. Rose	Montrose East of Glen Iris (4140)
Grass Vale Easter Rye ...	do. ...	24715	3-5-27	9-6-34	273	18	7,539	5·51	415·36	J. A. Sears	Montrose East of Glen Iris (4140)
Kurrawong Pet 5th	A.I.S. ...	16042	2-8-26	20-5-34	273	13	11,175	3·69	412·22	A. E. Grant	Premier of Kurrawong (1212)
Claremont Stella 3rd	do. ...	17920	31-12-25	15-3-34	273	27	10,851	3·9	409·65	Clarem't Hosp'l Insane	Searchlight of Sunnyvale (2302)
Summerlea Hobby 2nd	do. ...	2437	13-3-28	4-5-34	273	28	11,364	3·44	391·51	Dunkley Bros. ...	Musket of Claremont
Kurrawong Snowdrop 22nd ...	do. ...	18229	14-10-28	27-4-34	273	21	9,918	3·9	386·74	W. G. Burges ...	Merry Count of Berry (2692)
Wollongbar Dessie 2nd ...	Guernsey ..	1121	21-5-24	4-7-34	273	22	7,251	5·22	378·47	Muresk Agricultural College	Renoun of Wollongbar (415)
Summerlea Tulip 1st	A.I.S. ...	Foundation cow	28-7-26	12-6-34	273	15	10,065	3·74	376·47	Dunkley Bros. ...	Musket of Claremont
Banyule Silvermine 59th ...	Jersey ...	29033	10-2-29	24-5-34	273	23·5	8,070	4·65	375·18	Dept. of Agriculture...	Banyule Superstrain (4529)
Moorlands Dot	do. ...	31236	16-5-29	24-6-34	273	16	7,323	5·11	374·21	L. Temple	Melrose Romeo (5861)
Kurrawong Nancy 3rd	A.I.S. ...	1373	9-3-29	20-5-34	273	19	9,432	3·89	367·09	D. Bevan & Sons ...	Premier 2nd of Kurrawong (2693)
Vision of Blacklands	do. ...	10282	2-5-26	25-4-34	273	18	9,054	4·00	362·94	W. G. Burges ...	Fussy's Monach of Hillview
Grass Vale Sweet Maggie 2nd ..	Jersey ...	28229	27-3-29	27-6-34	273	16	7,518	4·82	362·41	R. H. Rose	Starbright Sweet Duke of Glen Iris (3710)
Karrawarra Champion 2nd ...	A.I.S. ...	1253	6-5-28	21-4-34	273	21	9,318	3·87	361·27	D. Bevan & Sons ...	Sailor of Karrawarra
Springmead Fern	Jersey ...	27213	5-3-28	6-5-34	273	18·5	7,255	4·93	357·64	Dept. of Agriculture ...	Springmead Islander (4359)
Crantock Cream Star	do. ...	34723	14-8-28	27-6-3	273	14·5	5,458	6·5	356·54	B. Burnside	Crantock Starlight's Chief (5790)
Clarendon Eyre Tangerine 2nd	do. ...	33952	24-4-29	9-6-34	273	24	8,157	4·31	352·21	Sabina Vale Stud Farm	Clarendon Eyre Eminent's Music Master (6191)
Moorlands April	do. ...	23687	3-8-26	15-3-34	273	16	6,543	5·36	351·10	P. Rose (Est. of) ...	Colonel of Melrose (4015)

Telyarup Della 2nd ...	A.I.S. ...	2503	11 11 28	3 5–34	240	13	8,745	3·93	344·01	A. E. Grant	Baron of Darbalara (2824)
Greenmount Bonnie Lass ...	Jersey ...	28237	23 3 28	11 7 34	273	13	6,609	5·08	335·89	A. J. B. Strempel ...	Werribee Starbright's King
Moorlands Chloe ...	do.	28214	2–5 28	12 8 34	273	14·5	6,343	5·26	334·09	P. Rose (Est. of) ...	Colonel of Melrose (4015)
Greenmount Bo-Peep ...	do.	20902	24–6 25	7 8 34	273	18·5	7,409	4·44	328·90	A. J. Strempel ...	Werribee Starbright's King (2602)
Wooroloo Alice 2nd ...	A.I.S. ...	2517	19 4 28	6–5–34	273	16·5	7,414	4·34	322·12	Wooroloo Sanatorium	Triumph of Pine Creek (2515)
Summerlea Red Rose 1st ...	do. ...	...	1 8 26	17–2–34	273	23	9,249	3·42	316·29	Dunkley Bros. ...	Musket of Claremont
Nooka Lass	Jersey ...	28187	14–1–29	14–3–34	273	18·5	6,655	4·5	300·64	S. P. Herbert ...	Jessey's King of Sarnia (4578)
Summerlea Hobby 1st ...	A.I.S. ...	...	10–7–21	24–5–34	273	18	8,424	3·45	290·81	Dunkley Bros ...	Lord of Summerlea
Woodendale Lassie ...	Jersey ...	...	14–6–28	30–8–34	273	13	5,814	4·9	288·20	F. P. Atwell	Mokine Lady's Chief (4911)
Moorlands Bemil ...	do. ...	20885	21–8–25	1–7–34	240	...	5,700	4·88	278·70	P. Rose (Est. of) ...	Colonel of Melrose (4015)
Summerlea Betty 1st ...	A.I.S. ...	...	23–8–25	7–5–34	273	14	7,632	3·49	266·68	Dunkley Bros. ...	Musket of Claremont
Grantham Easter Rye ...	Jersey ...	24932	7–9–28	7–6–34	273	8	4,524	5·80	262·70	J. A. Sears	Merry King of Greenmount (4306)
Telyarup Milkmaid II. ...	A.I.S. ...	2505	15–10–28	23–3–34	273	6·5	7,384	3·48	258·15	A. E. Grant	Baron of Darbalara (2824)
Tipperary Pansy ...	do. ...	2442	2–12 28	28–4–34	180	4	6,135	4·1	255·81	E. T. Thatcher ...	Villiers of Darbalara (2386)
Woodendale Girlie ...	Jersey ...	25061	12–5–26	15–8–34	240	8	4,935	4·9	242·52	F. P. Atwell	White Prince of Roelands
Cookalabie Gem	Guernsey	3770	16–2–28	11 7–34	180	...	4,740	5·0	239·55	G. E. Scott	Cookalabie Pride
Summerlea Melba 1st ...	A.I.S. ...	5134	29–1–29	1–5–34	273	7	6,846	3·44	236·10	Dunkley Bros. ...	Victor of Telyarup
Koojan Daffodil ...	Guernsey	2231	4–10–28	11–4–34	240	9	4,335	5·4	234·15	A. W. Padbury ...	Koojan Golden Governor (595)
Juadine Sparkle 2nd ...	Jersey ...	...	4–6–28	2–8–34	150	26	5,340	4·4	233·45	L. Hancock	Mokine Hero
Koojan Bonnie Buttercup ...	Guernsey	2230	18–10–28	17 4 34	240	7	4,275	5·4	232·14	A. W. Padbury ...	Koojan Golden Governor (595)
Moorlands Crystal	Jersey ...	28225	31 7–28	20–7–34	210	9	4,560	5·0	226·90	P. Rose (Est. of) ...	Grafter of Melrose
Summerlea Snow Queen 1st ...	A.I.S. ...	Foundation cow	20 8 25	15–6–34	273	8	6,324	3·56	225·06	Dunkley Bros. ...	Musket of Claremont
Mokine Heroine 5th	Jersey ...	34358	25 9 28	31–8 34	273	8·5	5,456	4·1	221·74	T. H. Wilding ...	The Valley Twylish Fox
Princess	A.I.S. ...	Foundation cow	8–8–24	20–7–34	240	10	6,270	3·27	205·51	Dunkley Bros.	
Moorlands Camilla	Jersey ...	28207	4–7–28	14–8 34	210	10	4,395	4·5	198·24	P. Rose (Est. of) ...	Colonel of Melrose (4015)
Moorlands Coral	do. ...	28222	15–8–28	6–7–34	150	12	3,705	5·2	193·80	P. Rose (Est. of) ...	Grafter of Melrose
Eva of Marks Villa	A.I.S. ...	16479	15–4–26	27–5–34	150	24·5	4,395	4·1	182·55	P. E. Warburton ...	Haig of Minnamurra
Summerlea Dairymaid ...	do. ...	5130	17 8 28	8–6–34	273	10	5,970	3·01	180·01	Dunkley Bros. ...	Victor of Telyarup
Minathorpe Carnation 4th ...	do. ...	2475	2 8 28	12–8 34	120	23·5	4,230	4·1	173·46	R. Bee	Collier of Darbalara (1997)
Minathorpe Blanche 6th ...	do. ...	17937	13–6 28	20 5–34	90	24	2,400	4·4	106·86	R. Bee	Collier of Darbalara (1997)
Greenmount Charming Bells 2nd	Jersey ...	23708	12–3–26	24–10–34	60	35·5	3,235	3·3	104·19	A. J. B. Strempel ...	Cheerup of Hamel Lea (4307)

COWS OVER 4½ YEARS AND UNDER 5 YEARS OLD—STANDARD 330 Lb. BUTTER FAT.

Wooroloo Red Rose 2nd ...	A.I.S. ...	2522	26–6–29	22–6–34	273	19	11,352	4·46	506·31	Wooroloo Sanatorium Farm	Triumph of Pine Creek (2515)
Granglea Pretty Primrose ...	Jersey ...	33038	31–10–29	9–6 34	273	25·5	9,001	5·60	504·10	Dept. of Agriculture...	Banyule Airo (5751)
Banyule Silvermine 66th ...	do. ...	28847	10–9–29	24–6 34	273	25·5	8,986	5·49	493·70	Sabina Vale Stud Farm	Milkmaid's Chief of Banyule (1412)
Minnamurra Palm Olive ...	Guernsey	2616	30–8–29	24–4–34	273	27	9,141	4·16	380·21	Muresk Agricultural College	Caramana Favour
Berrington Soprano 2nd ...	Jersey ...	...	5–10–29	19–5 34	273	23	8,049	5·63	453·52	Sabina Vale Stud Farm	Banyule Superstrain (4529)
Brookfields Lady Lillian ...	Guernsey	2720	28–11–29	18–7–34	273	24	9,207	4·86	447·45	G. E. Scott	Koojan Lord Barclay (1031)
Wyuna Jean	do.	2471	8–9–29	22–5–34	273	28·5	8,410	5·07	426·25	Muresk Agricultural College	Nundorah Buccaneer (612)
New Park Amy 7th	A.I.S. ...	1865	14 6–29	2–4 34	273	16	10,653	3·7	397·88	W. G. Burgess ...	Ruler of Greyleigh (1855)
Grantham Starlight Queen 2nd...	Jersey ...	28232	8–8–29	11–6 34	273	18	7,584	5·09	386·28	J. A. Sears	Grantham Starbright's King (5796)
Burnside Myrtle	Guernsey	2541	29–10–29	1–8–34	273	11	6,693	5·38	360·15	E. D. P. Hayes ...	Minnamurra Prairie Don
Melba 3rd of Tipperary ...	A.I.S. ...	2358	11–10 29	16–6 34	273	13·5	8,350	4·18	349·08	R. Bee	Melba's Re-Echo of Tipperary (2452)
Moorlands Duchess	Jersey ...	31239	11–7–29	26–5–34	273	12·5	6,758	4·96	335·10	P. Rose (Est. of) ...	Moorland s Romeo
Minathorpe Treasure 5th ...	A.I.S. ...	2477	20–10–29	28–7–34	273	9	7,332	4·5	334·13	R. Bee	Collier of Darbalara (1997)
Claremont Star 2nd	A.I.S. ...	2423	1–8–29	14–3–34	273	17	8,181	4·27	333·66	Claremont Hospital for Insane	Claremont Elector

HERD TESTING—*continued.*

COWS OVER 4½ YEARS AND UNDER 5 YEARS—STANDARD 330 LB. BUTTER FAT.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk last day of Test.	Weight of Milk for period.	Average Test.	Weight of Butter Fat for period.	Owner.	Sire.
						lb.	lb.	%	lb.		
Mokine Miss Fox	Jersey ...	34844	24-11-29	1-8-34	273	15	6,645	4·97	330·54	T. H. Wilding ...	The Valley Twylish Fox
Wyuna Goldie	Guernsey	2470	12-9-29	18 6-34	273	15	6,900	5·30	318·00	Muresk Agricultural College	Nundorah Buccaneer (612)
Moorlands Doris	Jersey ...	31235	14-5-29	17-3 34	273	11	5,823	5·02	292·81	P. Rose (Est. of) ...	Moorlands Romeo
Moorlands Dingle	do ...	31231	9-7 29	6-7-34	273	13	5,964	4·96	292·41	P. Rose (Est. of) ...	Melrose Rayleigh (5860)
Summerlea Milkmaid 5th ...	A.I.S. ...	5136	13-10-29	23-5-34	273	12	6,576	4·28	281·80	Dunkley Bros ...	Victor of Telyarup (2498)
Tipperary Priscilla	do. ...	2359	9-9-29	17-4 34	240	10·5	6,390	4·25	271·68	R. Bee	Villiers of Darbalara (2386)

COWS OVER 4 YEARS AND UNDER 4½ YEARS OLD—STANDARD 310 LB. BUTTER FAT.

Greenmount Bo-Peep's Fancy ...	Jersey ...	...	21-6-30	7-7-34	273	12	6,109	6·46	394·95	F. P. Atwell	Werribee Starbright King (2602)
Minnamurra Currency Lass ...	Guernsey...	2606	27-10-29	10-4-34	273	19·5	7,468	4·96	371·16	Muresk Agricultural College	Caramana Favour
Summerlea Tulip 3rd	A.I.S. ...	5140	2 8-29	1 4-34	273	23	7,989	3·35	267·63	Dunkley Bros. ...	Victor of Telyarup (2498)
Summerlea Victoria 2nd ...	do. ...	5141	21-8-29	20-3-34	273	23	7,569	2·97	225·10	Dunkley Bros. ...	Musket of Claremont (Fdn.)
Summerlea Countess 2nd ...	do. ...	5129	1-8-29	28-3-34	240	11	6,630	3·14	208·80	Dunkley Bros. ...	Victor of Telyarup (2498)
Longridge Bess	do. ...	5104	15 8 30	19-12-34	120	12	2,520	4·3	109·35	R. Bee & Sons ...	Minathorpe Kitchener (434)
Colmyn Nellie Rye	Jersey ...	34754	8 7-30	7-9-34	30	16	1,155	3·8	45·72	C. H. Ironmonger ...	Colmyn Captain Mac (5855)

COWS OVER 3½ YEARS AND UNDER 4 YEARS OLD—STANDARD 290 LB. BUTTER FAT.

Travalgan Lady Mint	Jersey ...	34789	21-6-30	11-4-34	273	24	8,712	5·53	282·45	Robinson Bros. ...	Tessie's Masterpiece of Garden Hill (6506)
Wooroloo Betty 2nd	A.I.S. ...	7734	10 11-30	3-8-34	273	14·5	10,633	4·3	455·74	Wooroloo Sanatorium Farm	Triumph of Pine Creek (2515)
Staghorn Northern Belle ...	Jersey ...	34786	10 9 30	11 4-34	273	24	7,647	5·84	447·19	Robinson Bros. ...	Staghorn North Lark's Masterpiece
Springmead Lady Rose ...	do. ...	35866	26-7 30	25-5-34	273	25	8,745	4·55	397·77	Sabina Vale Stud Farm	Springmead Beaucaire (6315)
Wooroloo Red Rose 3rd ...	A.I.S. ...	5226	27-9-30	3 5-34	273	16	7,743	4·69	363·62	Wooroloo Sanatorium Farm	Triumph of Pine Creek (2515)
The Pines Belle	do. ...	4079	6-9 30	25-5 34	273	29	9,312	3·75	349·30	E. T. Thatcher ...	Democrat of Alve Bank
Grass Vale Lady Fowler 11th	Jersey ...	34817	26-5 30	2-5-34	273	14·5	5,833	5·93	346·35	R. H. Rose	Choice Goods of Garden Hill (4580)
Grantham Air Lady	do. ...	34824	18-7-30	21 4-34	273	12	6,501	5·26	341·99	J. A. Sears	Banyule Altitude (5793)
Greenmount Starbright Marinora	do. ...	34841	30-5 30	21-3 34	273	16·5	6,184	5·50	340·57	A. J. B. Strempel ...	Werribee Starbright's Butter King
Wooroloo Bloomer	A.I.S. ...	5218	5 10-30	28-3-34	273	21·5	7,924	4·25	337·50	Wooroloo Sanatorium Farm	Triumph of Pine Creek (2515)
Woodendale Buttercup ...	Jersey ...	34715	24-9 30	6-6 34	273	13	6,349	4·55	289·02	F. P. Atwell	Mokine Lady's Chief
Juadine Peerless Lily 4th ...	do. ...	40417	1-10 31	27-8-34	273	13·5	5,605	5·15	288·83	L. G. Hancock ...	Juadine Radiance (7598)
Greenmount Beauty	do. ...	...	10 10 30	30-6-34	273	9	5,337	4·86	259·56	F. P. Atwell	Grantham Starbright's King (5796)

COWS OVER 3 YEARS AND UNDER 3½ YEARS OLD—STANDARD 270 LB. BUTTER FAT.

Koojan Dairymaid	Guernsey	3543	13 2-31	13-3 34	240	14	7,960	4·98	396·39	A. W. Padbury ...	Homestead Ace (1631)
Swanlea Lovely 7th	A.I.S. ...	4284	12 2 31	5 6-34	240	17	9,241	3·58	330·87	A. E. Grant	Headlight of Parkview (1406)
Kartidale Girlie	Guernsey	3820	24-9 30	15 3 34	273	18	6,144	5·38	330·70	G. E. Scott	Minnamurra Rose Chief

Koojan Ace's Marigold ...	do. ...	3541	22 1 31	12-6-34	273	16·5	6,364	5·05	321·55	G. E. Scott	Homestead Act (1631)
Hillview Pride 3rd ...	A.I.S. ...	1747	25 3 30	28 6 34	273	17·5	8,962	3·49	313·45	P. E. Warburton ...	Mayflower's Emblem of Hillview
Claremont Lupin 8th ...	do. ...	5103	19 3 31	31-8 34	273	8·5	8,185	3·7	305·81	Bayley Bros	Claremont Elector (446)
Joadine Sparkle 4th ...	Jersey ...	40418	10-6 31	14-8 34	273	16	6,663	4·55	303·38	L. Hancock	Mokine Repulse (5867)
Travalgan Ice Cream ...	do. ...	34788	6-2-31	22 6 34	240	11	5,160	...	296·43	Robinson Bros. ...	Banyule Altitude (5793)
Woodendale Starbright ...	do. ..	42578	4 6-31	11-6-34	273	12·5	4,508	6·47	291·67	F. P. Atwell	Werribee Starbright's King (2602)
Wooroloo Margaret ...	A.I.S. ...	5223	7-10-30	7 4-34	273	15	6,780	4·26	289·04	Wooroloo Sanatorium Farm	Triumph of Pine Creek (2515)
Burnside Myra Bell ...	Guernsey	3323	13-2 31	27-7 34	273	13	5,319	4·91	261·42	E. D. P. Hayes ...	Denmark Radiant Chief
Denmark Rose Dame 2nd ...	do. ...	3280	18-7-31	19-7 34	273	5	4,845	5·18	251·11	Dept. of Agriculture ...	Wollongbar Reformer (538)
Crantock's Lady Primrose ...	Jersey ...	...	10 6-31	17-7 34	273	12	4,191	5·9	249·11	G. H. Burnside ...	Crantock Starbright's Montrose
Longridge Gentle 1st	A.I.S. ...	5106	6 1-31	16 6 34	273	12·5	5,797	4·22	244·90	R. Bee & Sons ...	Minathorpe Kitchener
Summerlea Tulip 4th	do. ...	...	21-5-31	14-7-34	240	13	5,850	4·0	232·74	Dunkley Bros. ...	Summerlea Searchlight
Mokine Empire Twylish 2nd ...	Jersey ...	...	27 9-31	28-8-34	273	9	4,182	4·77	199·68	T. H. Wilding ...	Mokine Repulse (5867)

COWS OVER 2¼ YEARS AND UNDER 3 YEARS OLD—STANDARD 250 LB. BUTTER FAT.

Grantham Easter Fairy ...	Jersey ...	34825	18 9-31	4-6 34	273	19·5	7,693	5·66	435·83	J. A. Sears	Greenmount Black Prince (6511)
Hillcrest Gloaming V. ...	A.I.S. ...	1589	22 9-31	28-5-34	273	24	9,237	4·14	382·80	P. E. Warburton ...	Kitchener of Hillcrest
Grass Vale Buttercup	Jersey ...	...	28-6 31	2-6-34	273	14	6,222	6·00	373·36	R. H. Rose	Campanile's Duke of Burekup (7287)
Glanavon Greta	A.I.S. ...	5108	14-7 31	8 5-34	273	20·5	7,951	4·30	342·57	D. Bevan	Villiers of Darbalara
Greenmount Gentle Lass ...	Jersey ...	34838	9-8-31	29 5-34	273	11	5,813	5·43	316·18	A. J. B. Strempel ...	Grantham Starbright's King (5796)
Greenmount Little Gem ...	do. ...	34839	9 6-31	10 5-34	273	13·5	6,010	5·22	312·68	A. J. B. Strempel ...	Grantham Easter King (6510)
Colmyn Patty	do. ...	...	5 9-31	29 7-34	273	10	5,445	5·37	292·86	C. H. Ironmonger ...	Colmyn Captain Mac
Grass Vale Golden Cream 6th ..	do. ..	40079	14-8-31	6-7 34	273	10·5	4,966	5·34	265·21	R. H. Rose	Companiles Duke of Burekup (7287)
Greenmount Marinette	do. ...	34840	24 5-31	26 4-34	273	11·5	5,659	4·62	261·75	A. J. B. Strempel ...	Grantham Starbright's King
Grass Vale Campanile's Nora ...	do. ...	40074	30 8-31	9-8-34	273	8	4,734	5·33	252·58	R. H. Rose	Campaniles Duke of Burekup (7287)
Milbank Joan 4th	A.I.S. ...	4976	7 5 31	24-3-34	273	16	5,898	3·83	225·45	Dunkley Bros. ...	Parkview Ruler
Summerlea Beauty 4th ...	do. ...	9309	2-8-31	10-7-34	240	12	5,880	3·53	207·72	Dunkley Bros. ...	Victor of Telyarup
Rodyr Parks Clarion	Jersey ...	...	5-7-31	26-3-34	240	13	3,225	6·3	205·53	L. Temple	Melrose Clarion
Claremont Maggie 4th	A.I.S. ...	...	5-9 31	4-5-34	210	13	4,275	...	184·17	Claremont Hospital for Insane	Searchlight of Sunnyvale (2302)
Woodendale Butterfly	Jersey ..	...	30-8 31	28-5-34	210	10·5	3,165	...	178·61	F. P. Atwell	Werribee Starbrights King
Tabbagong Topsy 15th ...	A.I.S. ...	7526	20-12-31	26-10-34	90	29	3,300	...	134·34	W. G. Burges ...	Parkview Reward 2nd (260)

COWS UNDER 2¼ YEARS OLD—STADARD 230 LB. BUTTER FAT.

Koojan Bonnie Evelyn ...	Guernsey ...	3899	7 4 32	3 8 34	273	25	7.220	5·56	402·49	A. W. Padbury ...	Homestead Ace (imp.) (1631)
Blacklands Beauty 10th ...	A.I.S. ...	...	2-4-32	8 4-34	273	27	9,336	3·9	363·75	W. G. Burges ...	Fussys Monach of Hill View (493)
Denmark Rosebud	Guernsey...	3876	14-3-32	15-5 34	273	17	6,471	5·57	360·63	Dept. of Agriculture ...	Wollongbar McQuarric
Claremont Maggie Morrison 12th ◄	I.A.S. ...	...	25 10 31	14 4 34	273	26	6,718	4·12	359·91	Claremont Hospital for Insane	Claremont Elector (446)
Denmark Prospers Lady ...	Guernsey ...	3273	6-12 31	30 3 34	273	19	5,907	5·85	346·08	Dept. of Agriculture ...	Koojan Golden Prosper (2283)
Claremont Biddy 19th	A.I.S. ...	...	19-10 31	12-4-34	273	26	8,703	3·97	345·55	Claremont Hospital for Insane	Claremont Elector (446)
Koojan Ace's Waterwave ...	Guernsey...	4337	23-8-32	1 4-34	273	19·5	6,208	5·49	340·94	A. W. Padbury ...	Homestead Ace
Colmyn Snowflake	Jersey ...	39327	10-11 31	29-3-34	273	19·5	6,508	5·16	336·16	C. H. Ironmonger ...	Rye Duke of Glen Iris (1994)
Grantham Easter Pride ...	do. ...	...	31-10 32	16 6-34	273	14	5,427	5·89	319·92	J. A. Sears	Greenmount Black Prince (6511)
Westby Lupin	A.I.S. ...	...	28-3-32	17-6-34	273	19·5	7,978	3·96	316·28	Bayley Bros	Telyarup Duke (956)
Fairfield Royal Lu Lu	do. ...	...	22-3-32	29-3-34	273	23	7,899	3·9	310·32	W. G. Burges ...	Kinsman of Greyleigh (111)
Denmark Golden Marie ...	Guernsey ...	3873	26-4-32	7-6-34	273	14	5,232	5·85	306·51	Dept. of Agriculture ...	Koojan Golden Prosper (2283)
Moorlands Grace	Jersey ...	...	3-5 32	19 5-34	273	6·5	4,835	6·17	298·70	P. Rose (Est. of) ...	Melrose Sultan (6930)

HERD TESTING—*continued.*

COWS UNDER 2½ YEARS OLD—STANDARD 230 LB. BUTTER FAT.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Calving.	No. of Days in Test.	Weight of Milk last day of Test.	Weight of Milk for period.	Average Test.	Weight of Butter Fat for period.	Owner.	Sire.
						lb.	lb.	%	lb.		
Blacklands Molesty III. ...	A.I.S. ...	...	20-5-32	24-7-34	273	21·5	7,820	3·76	294·58	A. E. Grant	Emperor of Blacklands
Wooroloo Betty III.	do. ...	7735	17-12-31	20-2-34	273	20	6,495	4·5	292·34	Wooroloo Sanitorium Farm	Triumph of Pine Creek (2515)
Wooroloo Wing Wing III. ...	do. ...	7748	11-5-32	29-7-34	273	16·5	6,380	4·44	282·21	Wooroloo Sanitorium Farm	Triumph of Pine Creek (2515)
Rodyr Parks Laddies Estrellita	Jersey ...	...	...	24-6-34	273	13	4884	5·64	275·41	L. Temple	Graceful Lad of Greenmount
Denmark Prospers Dinah ...	Guernsey...	3272	7-12-31	3 5-34	273	11	4,743	5·75	272·97	Dept. of Agriculture ...	Koojan Golden Prosper (2283)
Greenmount Milkmaid	Jersey ...	...	2-5-32	22-6-34	273	13	5,514	4·92	271·32	A. J. B. Strempel ...	Grantham Easter King (6510)
Nooka Violet	do. ...	...	18-2-32	3-7-34	273	5	4,950	5·34	264·22	S. P. Herbert ...	Springpark Prince Ragtime (5942)
Denmark Prospers Velvet ...	Guernsey ..	3875	23-3-32	12 4-34	273	13	4,959	5·25	260·54	Dept. of Agriculture ...	Koojan Golden Prosper (2283)
Muresk Princess	do. ...	3879	3-5 32	6-5-34	273	16	5,748	4·48	257·98	Muresk Agricultural College	Nundarah Climat
Colmyn Mirina	Jersey ...	...	13-5-32	12 7-34	273	12·5	4,897	5·2	255·75	C. H. Ironmonger ...	Rye Duke of Glen Iris
Grass Vale Lady Fowler 16th...	do. ...	...	2-9-32	13-8-34	273	13	4,779	5·15	246·17	R. H. Rose	Banyule Silvermine's Twylish
Colmyn Linla	do. ...	39323	19 3-32	1-5-34	273	14·5	4,468	5·48	245·18	C. H. Ironmonger ...	Colmyn Capt. Mack
Coogley Goldmines Rosebud ...	Guernsey...	4097	2-8-32	18-6-34	273	10·5	4,816	4·97	239·82	E. D. P. Hayes ...	Koojan Ace's Goldmine
Tabbagong Dove 8th	A.I.S. ...	7511	19 12-31	21-4 34	273	16	5,748	4·15	238·80	W. G. Burges ...	Parkview Reward 2nd (260)
Hillcrest Shamrock 5th ...	do. ...	13345	9 1-32	20 5-34	273	21·5	7,160	3·28	235·11	P. E. Warburton ...	Don of Hillcrest
Glenavon Flower	do. ...	8508	7-3-32	5-8-34	273	14·5	5,398	4·26	230·21	D. Bevan & Sons ...	Villiers of Darbalara
Coogley Radiant Queen ...	Guernsey	4104	7-10-32	1-6-34	273	8	4,419	5·15	227·89	E. D. Hayes	Denmark Radiant Chief
Colmyn Dulcie	Jersey ...	39322	18-3-32	30-5-34	273	11	4,293	5·26	225·90	C. H. Ironmonger ...	Colmyn Captain Mack
Brackenhurst Treasure	A.I.S. ...	5214	18-5-32	25-3-34	273	18	5,049	4·32	218·43	P. E. Warburton ...	Tipperary Royals Re-Echo
Moorlands Glory	Jersey ...	...	23-4-32	19-3-34	273	7	4,191	5·05	211·95	P. Rose (Est. of) ...	Melrose Sultan (6930)
Moorlands Girlie	do. ...	...	6 5-32	18 5-34	240	7	3,810	5·52	210·56	P. Rose (Est. of) ...	Melrose Sultan (6930)
Blacklands Myrtle 8th	A.I.S. ...	...	3-9-32	2-6 34	240	12	5,275	3·8	202·02	A. E. Grant	Parkview Limelight (370)
Claremont Belle 10th	do. ...	...	12-1-32	5-5-34	210	14·5	4,425	4·2	185·28	Claremont Hospital for Insane	Searchlight of Sunny Vale (2302)
Greenmount Butterfly	Jersey ...	40098	21-4-32	22-4-34	210	16·5	3,675	4·9	179·55	A. J. B. Strempel ...	Grantham Easter King (6510)
Summerlea Hobby 7th ...	A.I.S. ...	...	5-8-32	23-7-34	273	10·5	4,666	3·51	164·11	Dunkley Bros. ...	Victor of Telyarup
Moorlands Gleam	Jersey ...	...	2 5-32	19-5-34	180	10·5	2,595	5·7	147·81	P. Rose (Est. of) ...	Melrose Sultan (6930)
Longridge Blanche 1st	A.I.S. ...	...	20-4-32	4-7-34	150	14	2,820	3·8	106·08	R. Bee & Son ...	Minnathorpe Kitchener (458)
Coogley Goldmines Lady ...	Guernsey...	4093	3-8-32	20-9-34	120	...	2,170	4·7	102·48	E. D. P. Hayes ...	Koojan Ace's Goldmine
Greenmount Bonetiennes Twinkle	Jersey ...	44201	24-3-33	17-1-35	60	18	1,110	4·3	47·76	A. J. B. Strempel ...	Bellefaire Bonaparte's Bonetienne (9224)

METEOROLOGICAL INFORMATION.

Stations.	Temperature.				Rainfall.		Temperature.				Rainfall.		Temperature.				Rainfall.	
	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.	Maximum.		Minimum.		For Month.	Average.
	Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.			Mean.	Highest.	Mean.	Lowest.		
	MARCH, 1935.						APRIL, 1935.						MAY, 1935.					
					Inches.	Inches.					Inches.	Inches.					inches.	inches
Chapman State Farm	84·3	107·4	64·0	53·8	1·40	·78	81·2	90·2	57·6	44·4	1·35	·62	76·2	89·0	52·2	45·2	0·68	2·46
Geraldton	83·5	108·0	65·2	52·5	1·11	·58	80·4	91·2	60·9	47·2	3·65	·85	74·1	85·0	57·7	48·5	0·78	2·78
Walebing	85·4	108·0	59·7	51·2	·28	·84	78·7	86·1	52·1	40·0	1·43	·84	72·1	84·9	49·2	40·1	0·88	2·63
Perth	81·2	104·2	60·4	49·4	·16	·86	76·8	84·0	57·2	47·5	2·07	1·68	70·9	82·5	54·2	45·8	4·52	5·11
Kalamunda	81·4	103·0	58·4	49·2	·10	1·04	75·8	84·0	56·2	47·0	3·53	1·99	67·7	79·8	51·6	37·0	7·35	6·24
Bunbury	77·5	94·0	57·4	43·2	·06	·99	73·5	82·0	53·3	39·8	1·36	1·69	68·6	77·4	50·9	42·2	3·63	5·20
Bridgetown	80·7	104·0	50·1	34·0	·15	1·07	76·0	84·5	46·9	36·5	2·37	1·69	67·3	82·0	43·3	31·0	2·51	4·61
Albany	71·3	88·2	57·4	45·2	·34	1·61	71·2	83·2	54·4	48·0	2·00	2·80	67·2	81·0	49·8	42·0	4·45	4·98
Merredin State Farm	84·2	106·4	58·9	43·2	·29	·93	78·1	97·1	52·6	37·5	·99	·78	72·0	86·5	48·7	37·1	0·62	1·37
Northam	85·7	105·8	58·6	48·0	·27	·85	79·6	88·0	52·9	40·0	·61	·85	72·9	86·2	49·7	40·6	1·09	2·31
York	84·0	105·5	57·4	48·5	·33	·76	78·6	87·0	50·6	38·7	·52	·86	71·8	82·3	47·3	37·0	2·05	2·39
Narrogin State Farm	81·8	102·6	53·7	43·8	·05	·79	75·1	85·0	48·8	36·8	2·01	1·19	68·0	80·6	46·8	35·4	1·99	2·95
Katanning	79·3	101·0	54·1	41·3	·01	1·02	73·3	82·0	49·7	42·0	1·47	1·18	65·9	79·0	46·1	37·7	1·91	2·42
Cape Leeuwin ...	71·7	97·2	60·5	54·0	·22	1·21	70·9	80·0	60·0	55·0	1·38	2·25	67·2	81·2	57·7	53·0	3·65	5·90

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